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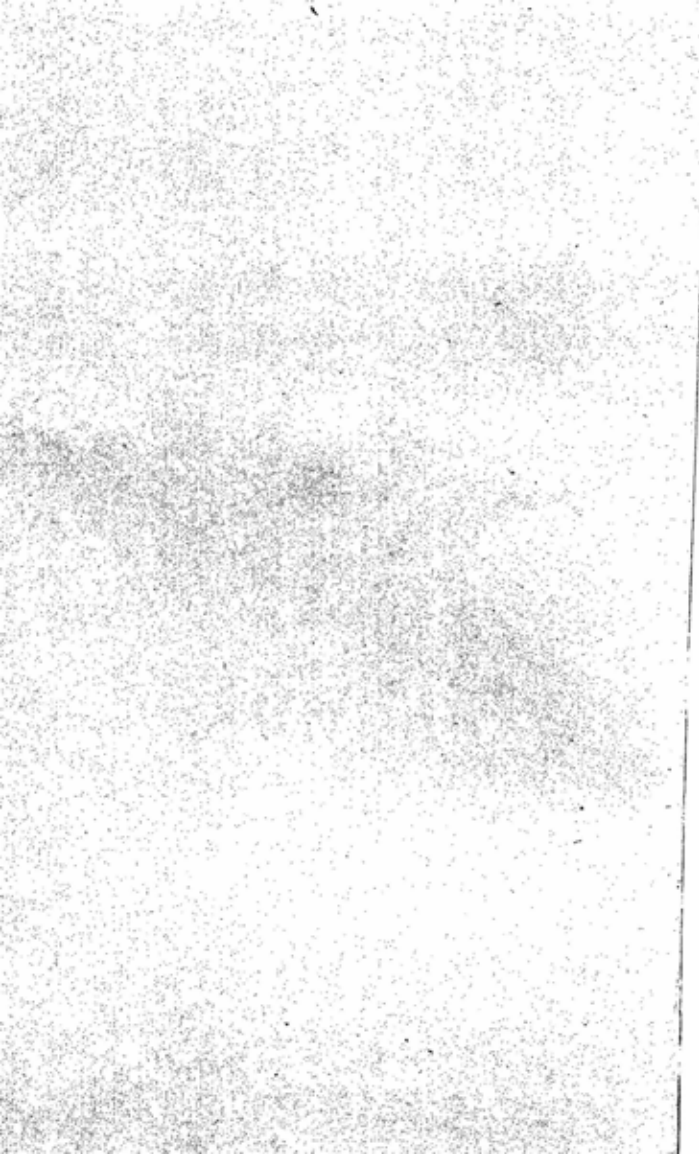
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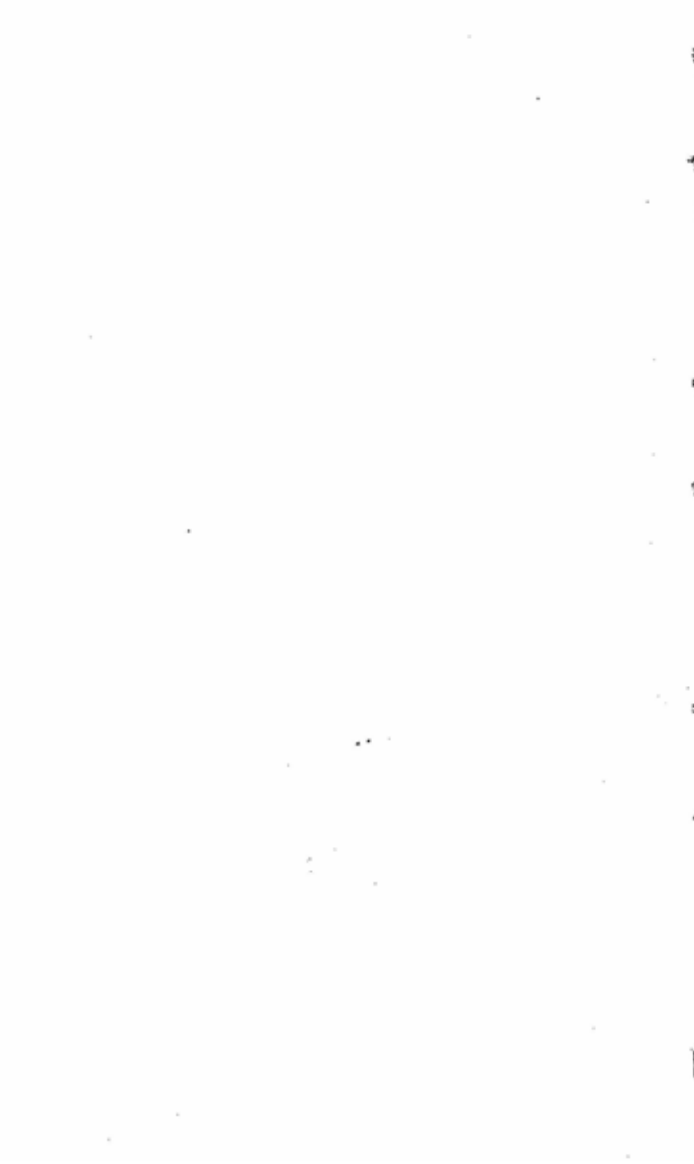
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UNIVERSAL DECIMAL CLASSIFICATION  
Theory and Practice





# Universal Decimal Classification

## Theory and Practice

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*Universal Decimal Classification*

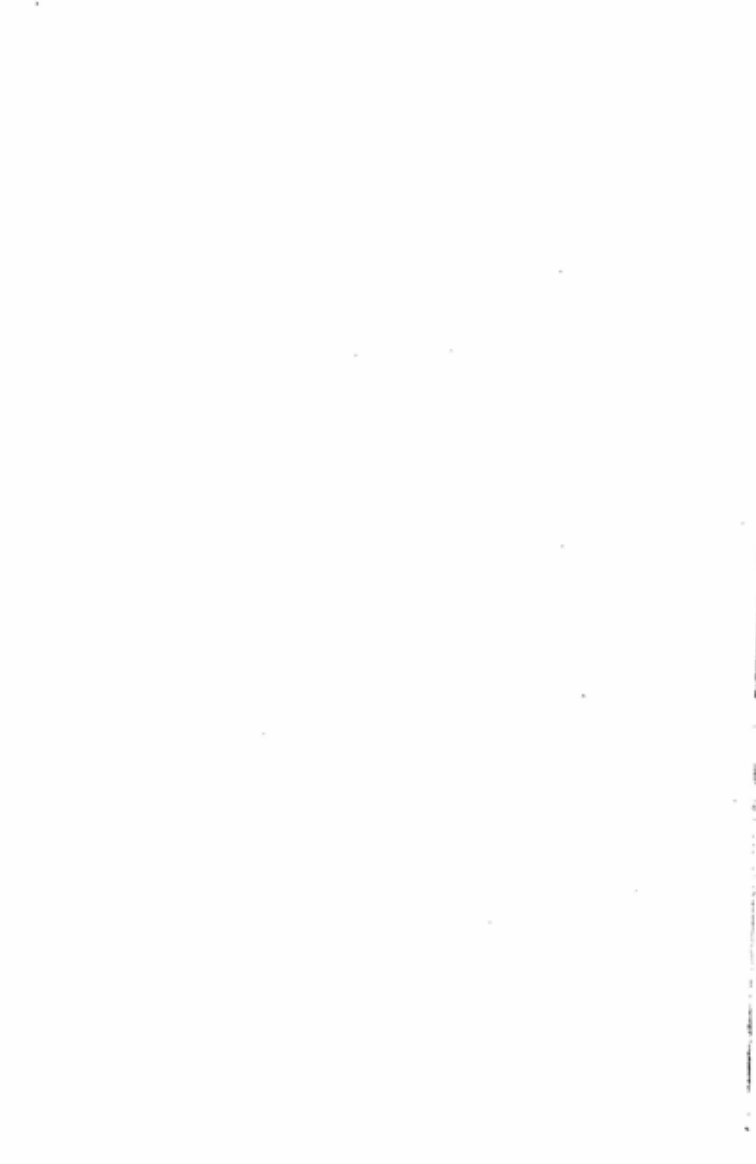
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*Dedicated to my parents  
Jatindra Nath Bose  
and  
Indubala Bose  
who are no more*



## Preface

The advantages of using the Universal Decimal Classification (UDC) lies in its being a comprehensive classification scheme. Apart from its applicability for technical processing of all kinds of documents including book, non-book materials in technical libraries and information centres, the scheme is useful for systematic arrangement of materials for the compilation of bibliographies, glossaries, abstracting and indexing journals, data store for information retrieval. The latter exercise is particularly useful to researchers who have to organise the data in card form.

Written primarily as a guidebook to the latest UDC BS 1000M (1985) the book aims at explaining the methodology and process for the classification of documents with ease and accuracy. Instances are not infrequent when the same document, even when subjectively classified, gets non-identical class numbers in different collections. Assuming that the UDC, being an analytico-synthetic classification system, freed from the rigidity of faceted schemes, the classifier has the autonomy to use logical inference to classify documents on the basis of subjects, class numbers for the same documents should not differ. The fact that it occurs leads one to think that there are some pitfalls in the system. But it should not be so because the methodology of classification, when it rests on a sound theoretical base, should yield the same result whoever may classify the document.

Care has been taken to explain the theoretical base, resultant methodology and the process of practical classification. In doing so, principles of practical classification are established which, being a consistent set of norms, would assist the classifiers to arrive at precise class numbers of documents. The UDC BS 1000M (1985) is somewhat different from the earlier UDC BS 1000A (1961) in the sense that the former

incorporates certain devices like parallel divisions, final digits etc., which were non-existent in the latter. These devices are instrumental in enabling the classifier to formulate numbers for a vast number of subjects with the help of enumerated tables which remain confined within a limited number of pages. But for these devices, the tables would have been unwieldy. How this brevity has been achieved will be evident from the examples on classification practice set towards the end of the book. The chapters on classification in respect of its theory and practice has been followed by an analysis of existing retrieval languages, and also what would constitute an ideal indexing system for an UDC classified file.

Drawing from his experience in using the UDC for the past 28 years and assisted by numerous documents on this subject, the author has compiled this manual with the expectation that it will be useful to those who are interested in the subject or need it for their professional activities. The author has taken particular care to elaborate upon the procedure and methodology for the classification of compound and complex subjects with consistency and precision. The language and approach to the subject have been maintained at a level simple enough for the beginners to understand and use it with ease and convenience.

Though basically an exposition on the Universal Decimal Classification, the book also discusses the implications of the relevant indexing systems. The reason is not far to seek. The classification system is primarily meant for the systematic arrangement of documents or their citations, and their subsequent retrieval on demand. But, class numbers representing subjects are constituted mostly of digits and sometimes alphabets and symbols. The sense behind them can be understood when interpreted through terms or keywords. The topics contained in these documents can be retrieved if the keywords are so rotated that each of them, accompanied by qualifiers, becomes an entryword in turn. This rotation of keywords brought about by mechanical device and subsequent computer-aided printing of their combinations makes it possible to attain high-speed classification-based indexing systems. This opens the gateway to

a hitherto unexplored domain of mechanised indexes. Added to it is the assured feasibility of mechanically manipulating the digits or parts of class numbers to generate multiple-entry systems in classified files.

In contrast to it, the conventional indexes of yore had been linear in conception and design. The scenario changed fast with the introduction of electronic digital computers for information processing. A perceptible change in the indexing pattern showed itself. The new generation of pre-coordinate and multi-faceted indexes serve as information retrieval tools and also for generating subject headings for library catalogues and diverse publications. In this changed perspective, the enunciation and study of conventional indexes is a step towards the realisation of essential utility of cyclic indexing system against linear ones. So, the last chapter of the book is committed to this problem.

The author wishes to acknowledge the assistance received from Shri S.K. Ghai, Managing Director, Sterling Publishers Private Limited, who had published his earlier book on information science within a short period, and has handled the present one with commendable expertise and competence.





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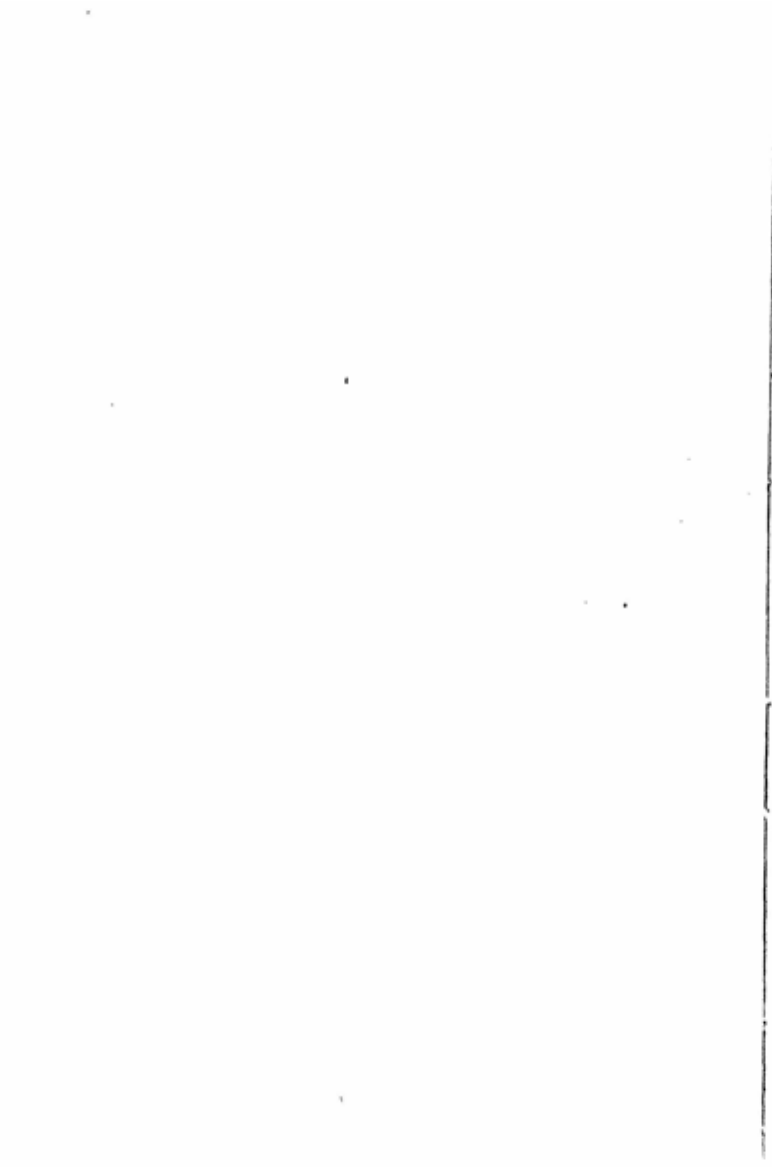
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## THEORY

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## Concept of Classification

### The inception

With the approval of the Lake Placid Education Foundation (New York), the proprietors of the Dewey Decimal Classification, and at the request of the British Society for International Bibliography (BSIB) and the Association of Special Libraries and Information Bureaux (ASLIB), the British Standards Institution (BSI) has prepared the Universal Decimal Classification (UDC) International medium edition. English text, BS 1000M : 1985 (FID Publication No. 571), which replaces the abridged edition of the Universal Decimal Classification BS 1000A : 1961, is the latest in the series with a more extensive version. Modifications authorised in the "Extension and Corrections to the UDC : FID Publication No. 248 upto Series 9, No 3, dated June, 1977, have been included in this edition. The BSIB and ASLIB have now been amalgamated as the Aslib. Issued by an arrangement with the International Federation for Documentation (FID), it is a part of the International Medium edition of the UDC, and comprises two parts, i.e. Part 1 : Systematic tables, and Part 2 : Alphabetical subject Index. The official language for the maintenance of the UDC are English, French and German.

Transcending language barriers, the UDC, based on numerals and symbols, aids communication on international level through interchangeability of information between departments, national institutes and organisations. Besides, comparative terminology in technical glossaries and vocabularies can be based on it.

The UDC schedules are used for the classification of books and documents in about one hundred thousand libraries and information centres all over the world. The UDC schedules



are needed by librarians, documentalists, abstractors, bibliographers, teachers and students of library science, and a wide range of users who are occupied with the task of information storage and retrieval, arranging documents in systematic order, publication activities etc.

The UDC has been adopted by the International Organisation for Standardisation (ISO) which has recommended it for adoption by the classification of published standards. It has, therefore, become the most widely used of all classification systems.

The UDC BS 1000M : 1985 has many new features and covers much more ground than the old schedule. With a vastly enhanced scope encompassing many more subject divisions and detailed classifications, this schedule is eminently suitable for technical libraries and information centres. Further, the BS 1000M (1985), being the latest schedule now in existence, the tables are up-to-date. Compressed within a limited number of pages and with no need for detailed enumeration of the tables, the schedule has been provided with certain devices for synthesis of topics not listed in it. The techniques guiding the application of these devices have been described in the forthcoming chapters.

### **The concept**

Classification is the process whereby similar things are grouped together, while dissimilar ones are separated. This principle can be extended to ideas contained in documents. When this is done, there emerges the field of library or document classification. In such cases the term 'ideas' denote a diversity of concepts, perceptions or items of information. This implies that when things (i.e. ideas) have some common or distinctive features, which differentiate them from others, the former can be grouped together into a class. Things which do not have the common feature are excluded. This class can, in turn, be divided into smaller classes on the basis of common distinctiveness. The process is continued until the entire gamut from the universe of knowledge to a class with only one number is, theoretically, covered. All useful classes

containing groups of related things, lie between these two extreme ends.

For division of classes into mutually exclusive classes, the principles of division (characteristics) are brought into play. Classes are then divided into subclasses by the application of one characteristic of division at a time. A second characteristic is next applied to the subclasses to yield further subclasses. The process continues till the characteristics are exhausted and the subject has been classified to its minute details. For example, when the characteristic 'ore deposits' is applied to the class 'Economic geology', it is divided into a number of subclasses, namely, iron ore deposits, manganese deposits, copper deposits, lead deposits and mercury deposits. If a second characteristic 'physical properties' is applied to each of these subclasses, then a series of further subclasses will be created, e.g., physical properties of iron ore deposits, chemical properties of manganese deposits, and so on. These subclasses are, in fact, subfacets within a facet.

Thus, a facet can be termed as the total of concepts derived when a particular characteristic of division is applied. In other words, subclasses thus produced when a class is divided by one principle of division at a time is called a 'facet'. These characteristics which are common to many categories, are arranged in lists or tables.

### **The systems**

Several systems of classification exist. These can be enumerated as follows:

- |            |  |
|------------|--|
| Special:   | —Used for covering a particular subject or laying emphasis on it.  |
| Scientific | —Used for systematic study of the phenomena of the natural world. This scheme assumes the form of taxonomies wherein a phenomena is isolated and allocated a unique place in it. |
| General    | —Used for displaying all recorded knowledge or the universe of information.  |

**Documentary** —Used for the management of documents for easy location and retrieval of information contained in them.

These documentary classifications can, in turn, be further divided into two following categories:

**Library classification**—for physical arrangement of library holdings, and guidance to their contents.

**Bibliographic classification**—for description and indexing of documents in general, and not restricted to any particular collection.

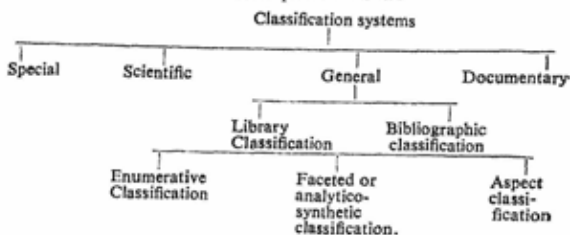
General classifications belong to any of the following three types:

**Enumerative classification**—comprises categories in which universe of information is divided and exhaustively listed.

**Faceted or analytico-synthetic classification** —Characteristics common to many categories are identified. These are then arranged into lists (or tables) each of which represents a facet. Subjects are thus analysed into their elements which can later be recombined or synthesised by the user.

**Aspect classification** —Phenomena of the natural world are classified in the perspective of discipline or context in which they appear.

All these classification systems can be represented hierarchically in the form of a tree as depicted below:



Out of all these systems, the UDC (Universal Decimal Classification) deserves particular attention because this book hinges on it.

### **The transition**

These classifications are not water-tight compartments. They overlap and may share some common features. As a result, the dividing line between them gets blurred whereby the UDC derives the merits of different systems of classification. Unlike the DDC, which was evolved as a library classification scheme, the UDC was developed as a bibliographic classification system. Also, being based on DDC, it has been found to be eminently suitable for use in libraries. The UDC, although belonging to general classification schemes, can be used for formulating special subject classifications, and many specialised editions have been derived from it.

As already stated, the UDC is the result of an attempt to convert an enumerative (i.e. UDC) into a faceted (i.e. analytico-synthetic) scheme. Thus, the UDC can be termed as a blend of two categories of classification, i.e., enumerative and analytico-synthetic. The UDC contains two types of tables, i.e. main tables and auxiliary tables. The former may be said to be enumerative, while the latter is a combination of analytico-synthetic elements. Also like many general schemes, the UDC is an aspect classification. This can be explained by the following example:

The subject 'aircraft', which can be classed at 629.7, has been allotted various places in the UDC schedule according to various aspects of the subject. These aspects can be aeronautical engineering 629.73, aerodynamics 533.69, aerofoil design 533.69.04, lighter-than-air aircraft 629.733, propulsive force 62-80, and aviation laws 347.82. It can also be classed at other numbers depending on respective peripheral aspects. A general document on 'aircraft' containing all these aspects can be theoretically classed at all those numbers. But it is not done in practice. Depending upon the bias of the collection or the primary facet of the subject, one number can be selected and the document classified by that one. With a

view to solve such a problem, one of the ultimate aims of this manual is to find out a method for the determination of the primary facet of a subject.

Further, like its base, i.e., the DDC, the UDC is also a documentary classification scheme. It is particularly suitable for subject identification, indexing and description of documents which may belong to any specific collection or exist independently.

### **Analytico-synthetic scheme**

From the foregoing discussion, it will be apparent that the UDC is primarily an analytico-synthetic numerical classification system. This implies that the UDC belongs to that category of scheme which gives the classifier the maximum autonomy in constructing numbers for new specific subjects not enumerated in the schedules. In fact, all modern schemes of classification are faceted to a certain degree, i.e., they provide tables of constant numbers for divisions relating to time and to space. In other words, a classification scheme which allows the classifier to build up the notation for a particular document from various unit schedules is called an analytico-synthetic classification. The faceted classification is also called analytico-synthetic because the subjects are analysed into their elements which have to be recombined or re-synthesised. Ranganathan's colon classification is a typical example of faceted scheme. It may be repeated here that the UDC is analytico-synthetic because it is the result of an endeavour to develop an enumerative scheme, i.e., DDC, into a faceted classification. This makes the UDC an ideal tool for subject classification. Documents, when classified by the UDC, can be arranged in their respective subject areas so that the information contained in them can be retrieved quickly and easily. Further, the UDC is invaluable in classifying the subject areas of science and technology. Due to non-dependence on alphabet or language, it has been accepted internationally. Due to its constant amplification and modification to meet the emerging needs, the UDC spans the ever-increasing universe of knowledge.

The main structure of the UDC has been originally taken from the Dewey Decimal Classification (DDC), but it differs

from the latter in respect of its auxiliary notation of distinctive symbols. With help of these auxiliaries, complex subjects can be designated, classified and retrieved in terms of their component features. These features can be classified independently. Thus the need for repeated enumeration of similar concept in different subject fields are substantially reduced. The UDC is known as the 'Universal' because it treats all knowledge as an integral pattern of more or less related concepts.

The UDC is kept up-to-date with advances in all fields of knowledge with the help of an international network of UDC revision committees which work under the general supervision of the FID (Federation Internationale de Documentation) and its Central Classification Committee. The results of their deliberations are circulated first as drafts and then as formal proposals (P-Notes) to participants and subscribers. These P-Notes are very often modified before final authorisation, and the users are, therefore, advised to rely on the cumulative 'Extensions and Corrections to the UDC'. Organisations and individuals of all nations participate in these activities. Thus it is apparent that the UDC, which is maintained through a network of organisations and individuals, is truly international in character and coverage.

### **The origin**

The first edition entitled 'Classification and subject index' was published by Melvil Dewey, the American Librarian, in 1876. With 10 pages of tables containing 919 headings, it had no decimal fractions and was not called decimal. The three digit minimum and the decimal point after the third digit were introduced and the scheme was extended in successive editions. It was the widely used in the USA and other English-speaking countries. Thus, the norm of a systematic code which proposes the subject as a primary means of arranging and retrieving literature in libraries had been established.

The Institut International de Bibliographie (IIB) had been founded in Brussels. It started a project, entitled 'Universal

Bibliographic Repertory' which was to be a comprehensive classified index to all published information. Paul Otlet (1869-1944) and Henry La Fontaine (1854-1943), who had been entrusted with the project, obtained a copy of the Dewey's Decimal Classification (Ed. 5, 1894). In it, they visualised the immense possibility of accommodating the details needed for bibliographic work due to expansibility of decimal numbers which can serve as an international language. It was expanded by them and published by the IIB (in French) from 1904 to 1907. Known as the 'Handbook to the Universal Bibliographic Repertory' (Manual du Repertoire Bibliographique Universel), it contained about 33000 sub-divisions. They realised the implications of the scheme and using their ingenuity, introduced a number of innovations which had ultimately resulted in the publication of the first edition of UDC. The Dewey Decimal Classification (Ed. 5, 1894) was a purely enumerative classification. This means that all the envisaged subjects were listed and coded in it. The new version allowed synthesis whereby compound numbers denoting all possible relations between subjects were identified and symbols were designed to represent them. Besides, a separate list was prepared containing characteristics common to many subjects. The Dewey first edition had to some extent, contained repeated patterns of digits where the same characteristics of division had been applied. But, now the terminal digits are detached and listed as tables of auxiliary members. These could be added where required by the classifier. This was a synthetic principle which enabled one to have a detail of level much greater than that in the published scheme. This had achieved combination of higher precision with economy of presentation. Besides, the purely enumerative content had been considerably expanded to meet the needs of the Repertory.

Thereafter, Frits Donker Duyois of the Dutch Patent Office had extensively revised and expanded the science and technology sections. Containing over 70000 subdivisions, it was published from 1927 to 1933. The Universal Bibliographic Repertory was then published independently under the title 'Classification Decimale Universelle'. This one, modified and

improved with the help of approved amendments in various supplements and in the serial "Extensions and Corrections to the UDC", was published in two later editions.

In Germany, a third edition was edited and published by Carl Walther from 1934 to 1951.

In the United Kingdom, Dr. S.C. Bradford (1878-1948), the Keeper of the Science Museum Library from 1925-1937, adopted UDC in 1928. The "Classification for work on pure and applied science in the Science Museum Library", was the first selective edition of the UDC in English (Published in 1936) with emphasis on science and technology.

### **Formative stages**

The Institut International de Bibliographie (IIB) changed its name to Institut International de Documentation (IID) in 1931, and again to the Federation Internationale de Documentation (FID) with its headquarters at the Hague. The UDC is managed and maintained by the FID. The "Extensions and Corrections to the UDC" is now issued annually. There are now editions of various lengths of UDC available in 23 different languages.

The UDC is managed by the FID which works in collaboration with national organisations in many countries. These, in turn, have user participation in consultative capacities. As the profile of the UDC is subject to the needs and opinions of users, the scheme is more user-based than any other contemporary classification system.

A complete master version of the UDC, consisting of the text of French Edition (1927-33) is maintained by the FID and kept up-to-date through modifications imposed by approved amendments since that date. The authenticity of editions of the UDC, which are proposed to be published, is checked against this master version. As represented in the master version, the current UDC includes texts in all of the three official languages. Authorised by the FID, member organisations of various countries publish versions of UDC editions in their own languages. These versions are checked by the FID before publication. The editions, that are published in



single language, are known as language editions. The British Standards Institution (BSI) is authorised to publish English language editions.

The UDC is being continuously revised since its first edition (1904) in such a manner that newly emerging concepts and even those that were missing in earlier editions could be incorporated even before later editions are published. As already stated, amendments that are proposed to be included are circulated in communications, known as P-Notes, to subscribers and publishers of UDC. Comments, if any, received from them, are considered by the FID. The comments that are acceptable become authorised and published as the official text. These published amendments ultimately find their way into language editions. It will be apparent that P-Notes are transient materials which can be modified, amended or rejected altogether.

Earlier, from 1949 these published amendments were known as 'Extensions et Corrections'; then the title changed to 'Extensions and Corrections to the UDC'. Starting as a semi-annual, it later became an annual with cumulation in 3 year series. The text of P-Notes or that of the 'Extensions and Corrections to the UDC' can be in any or all of its official languages. The later publication helps the classifier in updating the UDC. The BSI publishes new versions containing the amendments to replace old editions.

All users can send proposals for amending UDC, and the FID follows it up according to procedures set for this purpose. The UDC has been accepted widely in many countries due to many advantages of its use. Backed by a vast organisation like the FID with its consultants spread all over the globe, and a well-organised administrative machinery to take care of the publication through its successive stages of revision, the user finds the UDC a convenient tool for classification of the universe of knowledge and handling all technical processes that are involved in compilation of indexes, bibliographies etc.

The natural language has many ambiguities which can be eliminated by using UDC notation. The main advantage of

the UDC lies in its notation. Other advantages of the UDC notation is that it is an artificial language based on Arabic numerals. For example, the term 'corn' may mean grain (agriculture); it may also mean keratosis (medical sciences). In the former case, it is denoted by 633.1, while the latter gets the class number 616.003.87. In the United States, the term 'corn' signifies maize (agriculture) which is classed at 633.15. Thus, with the help of UDC numbers, these homonyms get numerical concepts and are clearly defined. These concepts remain unaltered even when used in different contexts or perspectives. For example, the class number 616-003.87 can be analysed to show the chain in a hierarchy:

6 Applied Sciences, Medicine. Technology.

61 Medical Sciences.

616 Pathology. Clinical medicine.

616-003 Regressive and Reparative process.

616-003.87 Keratosis. Horny degeneration.

Thus the class number starts with the broadest number 6, and ends with the most restrictive number 66-003.87. This number fixes the conceptional hierarchy of keratosis.

### **Auxiliary tables**

The UDC consists of main and auxiliary tables. The main tables represent primary notation which reflects its close relation with the DDC. In the DDC, the main classes are denoted by 3 digits, while a single digit represents the main classes of the UDC. This introduces an element of brevity in its notation. These main classes of UDC, which are broadest, are as follows :

- 0 Generalities. Science and Knowledge. Organisation.. Information etc.
1. Philosophy. Psychology.
2. Religion. Theology.
3. Social sources. Law. Government etc.
4. Vacant.
5. Mathematics and natural sciences.
6. Applied sciences. Medicine. Technology.
7. The arts. Recreation. Entertainment. Sport.

8. Language. Linguistics. Literature.

9. Geography. Biography. History.

Previously, class 4 represented linguistics. It was cancelled in 1963, and the subject was merged with the class 8 literature. Class 4 is now vacant.

The concepts of a classification scheme are represented by the notation. This is a code whereby the concepts are aligned in a systematic order. The ordinal value of concepts in the classification scheme is fixed by the notation. In UDC, the notation is in Arabic numerals which possesses an ordinal value.

These broadest or main classes, denoted by single digit Arabic numerals, are, in turn, divided into sub-classes which are represented by longer two-digit numbers. These numbers represent more restricted concepts, e.g., class 6 is divided as follows:

60 General matters. Inventions.

61 Medical sciences.

62 Engineering. Technology in general.

63 Agriculture and related sciences and techniques.

64 Housekeeping. House economics.

65 Management and organisation of industry, trade communications.

66 Chemical technology. Chemical and related industries.

67 Various industries, trades and crafts.

68 Finished or assembled articles. Precision mechanisms.

69 Building trade, materials, practice etc.

These two-digit classes are further sub-divided yielding three digit classes which represent even more restrictive concepts. As the process of division continues, the concepts get more and more restrictive till they are theoretically exhausted.

The division of main tables follows a hierarchical pattern with the broadest classes at the highest level, and the most restrictive classes at the lowest level. The more the degree of division or detail, the greater is the length of class number; thus, the hierarchy of concepts within respective disciplines are reflected in class numbers which follow numeric hierarchy.

Now, let us get acquainted with certain terms like superordinate, coordinate, subordinate classes, and array. For this purpose, the following class numbers can be considered:

- 3 Social sciences.
- 33 Economics. Economic scene.
- 34 Law, Jurisprudence.
- 341 International law

With shorter numbers like 3 at the highest level denoting greater extension, the division proceeds to 341 which being placed at the lower level of hierarchy indicates greater intension. In between lies 33 and 34 which are classes of same length denoting a similar level of extension. In this case, class 3 is superordinate to 33 and 34. The classes like 33 and 34 are known as coordinate classes.

An array is an exhaustive set of coordinate classes. The term like 'generality' and 'specificity' are, sometimes, used in place of 'extension' and 'intension' respectively.

The notation of DC and UDC can accommodate any number of subdivision due to decimal fractions while the ordinal value of the rest of the sequence remains unaltered. Classes can be created for insertion of new ideas, developments or further details of information without disturbing the stability of the rest of the schedule. This capacity of the notation arises out of the nature of decimal fractions which can be extended infinitely. The UDC is thus said to possess a hospitable notation.

The most innovative feature of the UDC is its auxiliary notation comprising signs which allows for the construction or synthesis of compound numbers with the help of devices provided in the schedule. When a class number is created by synthesis of elements taken from different places in the schedule, the resultant number is known as the compound number. Auxiliary notations consist of two categories, *i.e.*, common auxiliaries and special auxiliaries. These are different from a simple number which occurs at any place in the schedule, or as an independent auxiliary cited on its own.

#### **Common auxiliaries**

By denoting such recurrent characteristics as are applicable

throughout the main tables, common auxiliaries establish interrelations between subjects. These consist of two kinds of symbols, *i.e.*, signs and sub-divisions.

The common auxiliary signs are a number of symbols which relate UDC numbers by linking them through coordination and aggregation to denote compound numbers.

As regards common auxiliary sub-divisions, they differ from auxiliary signs in two respects: firstly, these comprise numeric tables, and similar to the main tables, concepts in it are enumerated and the arrangement is hierarchical. Secondly, these concepts are followed, preceded by or prefixed to common auxiliary signs.

These common subdivisions can theoretically be attached to every class number in the main table for denoting any concept in the scheme more specifically. When these subdivisions are isolated and cited independently, the characteristics of division can be identified by the addition of an extra symbol. This symbol is known as the facet indicator.

For example, the digit 20 has several shades of meaning in the tables. But, the addition of an extra symbol (or facet indicator) determines the facet. The digit 20 when enclosed within parentheses indicates place facet, *i.e.*, (20) means cosphere; with quotation marks "20", means twenty-first century AD; with equal sign=20 signifies English language, and so on.

These common auxiliary subdivisions are divided into two groups; independent auxiliary tables, and dependent auxiliary tables. Functions of these two kinds of table can be enumerated as follows:

Independent auxiliary tables—These are affixed to UDC numbers when needed, and also used in isolation to form class numbers for documents. These are the auxiliaries of language, form, place, race and time. These tables have biterminal signs, *i.e.*, signs that enclose the number and demarcate it from adjacent ones. These biterminal signs enable the auxiliaries to be affixed anywhere within a UDC number with a few exceptions. This will be explained later.

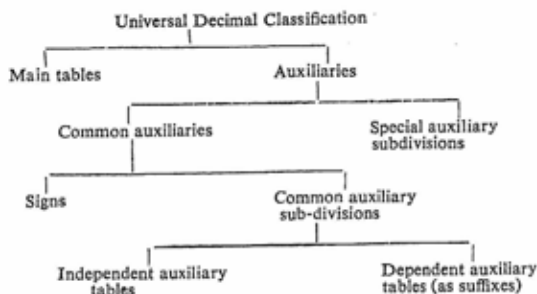
Dependent auxiliary tables—These are not used in isolation, but always affixed to UDC numbers.

### Special auxiliaries

Special auxiliaries denote those characteristics which are recurrent locally, and such being the case, these can be applied in a limited range of main tables. Differing from common auxiliaries which are listed at one place, these auxiliaries are dispersed throughout the table, and have limited applicability. Wherever valid for application, they are discernible by their appearance under main tables. These auxiliaries are enumerative, denoted by notations, and the same notations can be applicable in other parts of tables with different shades of meaning. As regards the principle of their use, these subdivisions are affixed as suffixes to class numbers, and also to their direct subdivisions even in the absence of instructions. In many cases, notes appear in the schedule instructing the range of their application.

### The structure

This brief introduction to auxiliaries will later be supplemented with details. Meanwhile, the structure of the UDC, in the form of an up-turned tree, is given below:



## 2

# Auxiliaries and Applications

### Signs and subdivisions

A 'tree' depicting the auxiliaries has been given in the previous chapter.

These auxiliaries can be divided into two categories, i.e., common auxiliaries and special auxiliary subdivisions. The common auxiliaries are of two kinds, i.e., signs and common auxiliary subdivisions. The latter category can be divided into two kinds, i.e. independent auxiliary tables and dependent auxiliary tables (as suffixes). A summary of these auxiliaries will be followed by more details.

Common auxiliary signs are as follows:

- + (plus) for coordination, addition.
- / (stroke) for consecutive extension.
- :
- [ ] (square brackets) for sub-grouping.
- :: (double colon) for order-fixing.

Independent auxiliary tables comprise the following:

- = language
- (0...) form
- (1/9) place
- (=...) race
- "..." time

Special auxiliary sub-divisions, denoting recurrent concepts, use the following notations:

- 1/-9 hyphen series
- .01/ 09 point-nought series
- '1/'9 apostrophe series

Dependent auxiliary tables consist of the following:

- .00... point of view, materials and persons.
- \* means of adding non-UDC notations.

These auxiliaries form the vital connecting link between different facets of compound and complex numbers. The significance and application of all these signs and subdivisions are explained, and whenever feasible, the explanations have been accompanied with examples.

### Meaning of symbols

Symbol + (plus) for coordination, addition.

When a compound subject cannot be denoted by a single number, this symbol connects (or coordinates) two or more separated non-consecutive UDC numbers to signify the concept, e.g.

- 53+54      Physics and chemistry
- (54+549)      India and Pakistan

When no number exists for a compound subject comprising a range of concepts, it can be denoted by the extension sign which connects two or more separated (non-consecutive) UDC numbers, e.g.

- 548/549      Mineralogical Sciences, Crystallography,  
Mineralogy
- 562/569      Systematic palaeozoology.

A general, coordinating and reversible relation is indicated where the concepts involved are of equal significance, e.g.

- 11 : 2      Metaphysics in relation to religion
- 2 : 53      Religion in relation to physics
- 327 (44 : 54) Foreign policy of France in relation to India
- 327 (54 : 44) Foreign policy of India in relation to France

When a compound number, denoted by two or more UDC numbers, are linked together with plus or colon, and the resultant number, in turn, is related to another number by colon (or modified by common or special auxiliary), this symbol is used for sub-grouping the concepts, e.g.

- 061.25 (100) International Federation
- 061 : 027      Library Associations



IFLA International Federation of Library Associations.

These individual numbers, when linked by colon and sub-grouped by square brackets, denote the following complex subject:

061.25 (100) : 061 : 027 IFLA International Federation of Library Associations.

When the order of component numbers in a compound number is fixed by :: symbol, the arrangement becomes irreversible. This symbol is, therefore, useful and applicable to UDC in a computer based mechanical information system, e.g.

061.25 (100) :: 061 : 027 IFLA International Federation of Library Associations

### Common auxiliary subdivisions

*Symbol = (equals) denotes languages*

When a main UDC number expresses the subject of a document, its linguistic form or language is denoted by these auxiliaries. It may be used when a very coextensive classification is needed for documents with emphasis on languages or where a detailed filing order is needed. Whether it will be prefixed or suffixed depends on the treatment of subject components of a document. If the document has to be filed by language, the sign is prefixed, e.g.

=40 (061.055.2) Womens' magazine in French language

When necessary, the auxiliary may be separated from the main number by colon, e.g.

=30 : 621.386.2 (030) Guidebook to X-ray tubes in German language.

The auxiliary is suffixed when the filing order is by subject, e.g.

547 (038)=82 technical dictionary on organic chemistry in Russian language.

When more than one language is involved, they will be denoted by auxiliaries arranged in ascending numeric order, e.g.

21 (0.068) 30 : 40 : 82 Rare documents on natural theology in German, French and Russian language.

For translations, the main number is followed by source language auxiliary number =0.3.2/.9 where .2/.9 indicates the entire range of language divisions, e.g.

621.039=03.30 Nuclear engineering documents translated from German.

When more than one language is involved, the source language is followed by target language =2/=9, e.g.

621.039=03.30=20 Nuclear engineering documents translated from German into English.

But when this document has to be filed with similar ones in English, the language auxiliary =20 can be cited first, e.g.

621.039=20=03.30 Nuclear engineering documents translated in English from German.

When the language auxiliary has to be cited first in a compound number, it is separated by a colon from the main number which is enclosed in round brackets, e.g.

=82 : 629.785 (0.062) Popular science book on space probe in Russia.

But, when the filing is by subject, the main number will be separated from the rest by language auxiliary, e.g.

629.785=82 (0.062) Space probes in Russian language: A popular exposition.

### **Form auxiliaries**

*Symbol (0...) (bracket nought) denotes form*

The form of presentation or documentary form of a subject, represented by a main UDC number, can be expressed by these auxiliaries, e.g.

66 (031) Encyclopaedias on chemical technology.

When documents have to be arranged by form, the auxiliary will be cited first, e.g.

(035) 579.67 Manual to food microbiology.

A literary form will be denoted by a compound number wherein it will be constructed from table 82 Literature in general. This form will be denoted by colon combination and enclosed within brackets, e.g.

	355.01 (0 : 82-14)	Ballads on war
from	355.01	War
and	(0 : 82-14)	In the form of ballads
when	82-14	Ballads

### Place auxiliaries

*Symbol (1/9) (brackets-one-to nine) for denoting place.*

When a subject is denoted by a main UDC number, its geographical areas, locations or space are indicated by place auxiliaries, e.g.

331.89 (410) Labour disputes in Great Britain.

327.55 (5) Non-aligned countries of Asia.

These auxiliaries help to form parallel division of 913/919 'Regional geography' e.g.

(32) Saudi Arabia

Following the principle that the decimal point occurs after every third digit, we get

915.32 Geography of Saudi Arabia.

This device can be used to signify the place aspect of a main number by colon combination, e.g.

553.982 : 915.32 Petroleum deposits of Saudi Arabia.

When this document has to be filed in the geography section, the components of the UDC number will be reversed, e.g.

915.32 : 553.982 Saudi Arabia—petroleum deposits

For creating a filing sequence based on place, the auxiliary may be placed first to create the following number:

(532) 553.982 Saudi Arabia—petroleum deposits.

The place auxiliary may also be placed at the end, e.g.

553.982 (532) Petroleum deposits—Saudi Arabia.

For classification of maps (where the emphasis is on place aspect), only place auxiliary can be used.

The place auxiliary may also be used to form parallel division of 93/99 'History', e.g.

953.2 History of Saudi Arabia.

### Race and nationality auxiliaries

*Symbol (=...) (brackets—equals) for denoting race, nationality*

The nationality or ethnic aspects of a subject (represented by a main UDC number) are denoted by these auxiliaries, e.g.

391.7 (=063) Ornament of Ethiopian races.

As these auxiliaries are evolved from language auxiliaries, they may distinguish linguistic-cultural groups, e.g.

(=460) Portuguese-speaking peoples

Auxiliaries derived from (=1.4/.9) will denote political nationality (citizenship of nation-states), e.g.

(=1.460) Portuguese.

### Time auxiliaries

*Symbol "... (double quotation marks) denotes time*

When a subject is represented by a main UDC number, its date, range or point of time can be denoted by these time auxiliaries, e.g.

62 "20" Technology in twenty-first century AD

The date is indicated on the basis of the Christian calendar, but non-Christian systems of time indication are also given in the scheme, e.g.

738.6 "632" Terracotta of the palaeolithic period.

Besides, other time concepts, i.e., seasons, geological times, dates, smaller time divisions, centuries, decades and ranges of time can also be indicated. While introducing time auxiliaries, the following points may be noted:

In addition to double quotation marks, plus and minus signs are also prefixed to distinguish the dates BC and AD, e.g.

"-0087" BC 87

" +0072" AD 72

As already stated, there exists a convention for using the

point after every third digit in UDC numbers. But, in contrast to it, the time elements of different magnitudes can be separated by point, e.g.

"461/464" Age expressed in hours and fractions of hours, days, weeks, months.

"430.6" Duration of 6 weeks

These two time auxiliaries can be combined to form a more specific concept, e.g.

"4630.6" Six weeks old.

The historical presentation of a subject is different from the period denoted by time auxiliaries, e.g.

2 (091) General history of religion

2 "15/19" Religion in modern times.

Sometimes, common auxiliaries are not sufficient for specification of a concept. Then the concept may need further code or notation which should be derived from a recognised non-UDC source. The source has to be mentioned in an accompanying note. Such code or notation, borrowed from numeric, alphanumeric and alphabetical codes (distinct from proper names), are separated by the asterisk from the main number, e.g.

546.791\*235 Uranium 235<sup>235</sup>

(Uranium isotope with atomic mass 235).

Abbreviations (distinct from codes), acronyms, and characters are added directly to the main number to denote proper names, and asterisks are omitted, e.g.

820.1 KEAT Poetry of Keats

When necessary, the whole number can be enclosed within an auxiliary biterminal sign, e.g. brackets. The following example will illustrate the point:

(543.1 NAG) Nagpur, Capital of Madhya Pradesh, India.

It is desirable to have abbreviations of some standard length so long as the names are apparent.

#### Point of view auxiliaries

Symbol .00... ('point nought nought')

A subject, sometimes to be considered from the most

general points of view—may be that of theory, concept, activity, process, function. They are generally used to denote handling of materials and technical in classes 5, 6 and 7. These auxiliaries, not used independently, are suffixed to main numbers, e.g.

577.18 Antibiotics

577.18.001.53 Laboratory research on antibiotics

These auxiliaries may be sparingly used.

Even when the auxiliary is available, it would be preferable to use a combination with the main number which express the concept with more precision, e.g.

656.2 : 65.011.4 Economic efficiency of rail transport

This number is more precise than that using the auxiliary, e.g.

656.2.003.1 Economic point of view of rail transport.

These auxiliaries may preferably be used where a satisfactory filing order is needed. It ensures that different concepts with a particular point of view are brought together.

### Common auxiliaries of materials

*Symbol —03 ('hyphen nought three')*

As the name suggests, these auxiliaries denote raw materials (or constituents) which go with the composition of finished products or objects. These are applicable mostly in sections 66/67 which deal with manufacture or processing of materials. It denotes the material aspect which is secondary to the main subject.

Composite materials can be denoted by these auxiliaries in combination with apostrophe which replaces —03, e.g.

	—036.4'786	Rubber coated fabrics
from	—036.4	Rubber
and	—037.86	Coated fabrics

### Common auxiliaries of persons and personal characteristics

*Symbol —05 ('hyphen nought five')*

Sometimes, a subject has personal aspects secondary to it and no direct subdivision or special auxiliary is available for

denoting the concept. In such cases, the persons concerned or their characteristics are denoted by these auxiliary subdivisions. This fact will be clear from examples showing different aspects of the problem.

The personal aspect of a subject can be expressed through the auxiliary —05, e.g.

301            Sociology  
301-05       Sociologists

What the agent is supposed to be denoted by the auxiliary —051, e.g.

930           Science of history  
930-051      Historians

Persons as targets (i.e., clients, users) or those who are at the receiving end can be expressed by —05, e.g.

326           Slavery  
326-052       Slaves

For further specification of this concept, subdivisions of —053/—058 may be added directly to this number, e.g.

326-052-055.1            Male slaves  
where,       —055.1            Male persons

Sometimes, personal aspects occur in the main tables. In such cases, the subdivisions of 053/058 can be added directly to the main number, e.g.

65.012.4-057.17            Managers  
from 65 012.4            Techniques and methods of  
   management  
and       —057.17            Managers in general.

The following example shows the combination of —05 auxiliaries with others:

65.012 4—057.14 (=540)    Indian managers  
where (=540)            Indian

The —05 auxiliaries are not applicable under 264. Otherwise, they can be applied throughout the main tables.

### Special auxiliary subdivisions

As stated before, the common auxiliary sub-divisions are used (with some exceptions) throughout the main tables with

the same meaning. But, this is not so with special auxiliaries which are different. These auxiliaries are used with different meanings in different parts of the main tables. These are listed following principal divisions in different parts of the main tables. This implies that the same recurring concept, as denoted by special auxiliaries, are applicable to those main numbers or their subdivisions.

The special auxiliary subdivisions use three kinds of notations, *i.e.* hyphen series -1/-9, point nought series .01/.09 and apostrophe series '1/'9.

It is necessary to explain the use and scope of these auxiliaries in detail.

#### **The hyphen series -1/-9**

These notations are different from that of common auxiliaries. They specify properties, components, constituent elements and other details of the subject represented by a main number. These are applicable only where listed in the main table, *e.g.*

621.333-7	Servicing of electric traction motors
where 62-7	Servicing, maintenance, protection.

These notations introduce an element of analytical (or differential) approach to the treatment of the subject, and occur mostly in 62/69, and also 82/89.

#### **The point nought series .01/.9**

These notations are very detailed. They denote the activities, processes, operations, machinery parts, apparatus, plant and equipment, and aspect studies of a subject denoted by a main number, *e.g.*

355.211.077.3	Administrative procedure of armed services recruitment systems.
where 35.077.3	Administrative procedure

Unlike -1/-9 auxiliaries, these auxiliaries are widely applicable through many sections of the main table.

#### **The apostrophe series '1/'9**

These auxiliaries shorten the length of UDC numbers of



compound subjects by compound notation. The main advantage is that these can be derived from main numbers by parallel division, e.g.

	669.15'24'26	Chromium-nickel-steel
from	669.15	Alloy steels
and	669.24	Nickel
and	669.26	Chromium

Chemical compounds resulting from reaction among multiple components are also denoted by compound notation. For example, the following two organic chemicals react to produce an ester:

	547.262'292	Ethyl acetate
from	547.262	Ethyl alcohol
and	547.292	Acetic acid

Another example of similar nature is given below:

	547.261'291	Methyl formate
from	547.261	Methyl alcohol
and	547.291	Formic acid

These examples indicate that numbers for organic compounds can thus be formulated through synthesis with the help of apostrophe when the numbers for reacting chemicals are given in the schedule.

Apart from organic chemicals, numbers for inorganic compounds can also be similarly formulated, e.g.

	546.173'131	Nitrogen trichloride $\text{NCl}_3$
from	546.173	Derivatives of nitrogen trioxide
and	546.131	Hydrochloric acid

It is apparent that the number for the resultant chemical compound has been formulated by replacing the digits 546 by the apostrophe.

A binary compound contains a metal radical (cation) and acid radical (anion). The number for such a compound can be formulated by adding the number for the anion to that of cation, e.g.

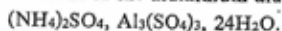
546.33'131	Sodium chloride $\text{NaCl}$ (common salt)
------------	---

from	546.33	Sodium
and	546.131	Chlorides

A chemical compound may contain several metallic radicals (cations) or acid radicals (anions). When the numbers for these radicals are combined to formulate a number for this compound, the numerically highest of the numbers for the metals is cited first, and those for other metals and acids are added to it in reverse numerical order. The following example will illustrate the process:

	546.623'226'171	Ammonium alum
from	546.623	Trivalent aluminium
and	546.226	Sulphates
and	546.171	Compound ammonium radical

The chemical formula of the aluminium alum is



For further elaboration, it may be mentioned that the alum is a class of isomorphous double salts. These can be denoted by the general formula  $\text{R}_2\text{SO}_4, \text{M}_2(\text{SO}_4)_2, 24\text{H}_2\text{O}$  where

R an atom of a monovalent metal or radical

M an atom of a trivalent metal.

Further examples are given below to indicate the methodology of application of the apostrophe for the formulation of numbers for compounds containing several radicals, e.g.

	546.723'623'226	Ferric ammonium alum
from	546.723	Trivalent iron
and	546.623	Monovalent ammonium radical
and	546.226	Sulphates

The chemical formula of this alum is  $(\text{NH}_4)_2 \text{SO}_4 \text{Fe}_2(\text{SO}_4)_3, 24\text{H}_2\text{O}.$

The number for potassium chromium alum can similarly be derived, e.g.

	546.76'32'226	Potassium chromium alum
from	546.76	Trivalent chromium
and	546.32	Monovalent potassium radical
and	546.226	Sulphates

The chemical formula for this alum is  $K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$ .

The following example can also be cited:

546.273'131	Boron trichloride $BoCl_3$
from 546.273	Trivalent boron and its derivatives
and 546.131	Hydrochloric acid and its derivatives

Examples are given below showing the formulation of numbers for compound subjects where special auxiliaries have been used singly and also in combination with other auxiliaries. For example, a single auxiliary can be used to formulate relatively simple numbers:

546.22-182	Colloidal sulphur
where- 182	Colloidal state in general

Another example showing synthesis of numbers for chemical compounds is given below:

547.062.057	Synthesis of phenol esters
where 54.057	Synthesis

The use of special auxiliaries has been extended to other classes also, notably in 3, the social sciences, e.g.

334.726'724	Multinational public undertakings
from 334.726	Multinational enterprises
and 334.724	public undertakings

These auxiliaries are also applicable to 8 Literature and Linguistics, e.g.

840-293	French musical drama
where 840	French literature
-293	Musical drama

Another such example may be cited:

856.081	Japanese literature—creative writing
from 856	Japanese literature
and 82.081	creative writing

An example of the application of several auxiliaries with different symbols forming a heterogeneous chain is given as follows:

891.2-13.09	Sanskrit epic poems—literary studies
from 891.2	Sanskrit literature
and 82-13	Epic poems
and 82-09	Literary studies

It may be noted here that the numbers for French, Japanese and Sanskrit literature have been derived with the help of the parallel division  $820/899 \approx 802.0/809.9$ . The methodology of parallel division will be explained in detail later.

An example is given below showing that several auxiliaries with the same symbol can be used for a homogeneous chain, e.g.

62-521-72	Lubrication devices of mechanically controlled machines.
from 62-521	Mechanically controlled machines
and 62-72	Lubrication devices

Another example of similar nature may be cited:

669-156-143	Hardened die-cut metals
from 669-156	Hardened, quenched metals
and 669-143	Die-cast, injection-moulded metals

Yet another example of the application of several auxiliaries with different symbols forming a heterogeneous chain is given below:

546.32'226-384.1.05	Preparation of potassium hydrogen sulphate
from 546.32'226	potassium hydrogen sulphate
and 54-384.1	primary acid salts
and 54.05	production preparation

The description and application of common and special auxiliary sub-divisions is only a preliminary step to the study of UDC structure. As already stated, the BS 1000M (1985) supersedes the erstwhile UDC BS 1000A (1961). The former differs from the latter in several respects. Apart from the vast expanse of the table, the schedule contains two auxiliaries, i.e. the symbol :: (double colon) for order fixing, and the symbol \* (asterisk) A/Z for further specification by non-UDC notation. These have been described.

**Filing order**

All these auxiliaries are applied for the formation of compound UDC numbers for subjects which have not been enumerated in UDC tables. The filing or listing order of such compound UDC numbers needs to be explained for indicating how documents have to be arranged on shelves, cabinets or folders. The alignment of UDC numbers follows from general (less restrictive) to particular (more restrictive). The filing order of documents bearing both simple and compound numbers follows a set of principles which can be enunciated as follows:

Coordination/addition symbol +, consecutive extension symbol/, relation symbol : and order-fixing symbol :: which interlinks or inter-relates simple UDC number to form compound UDC numbers. The common auxiliaries, which are least restrictive, are filed before others with more general meanings. Thus, these independent auxiliaries, which can be used alone or cited first, are followed by non-consecutive aggregation or consecutive extension of several numbers. These, in turn, have a concept which is broader than that of a simple number. This means that compound numbers with the plus, the stroke and the colon are filed before a single component with more restrictive meaning. For example, 53+54 will be filed before 53.

A number with an auxiliary as suffix has more restrictive meaning than a simple number, and will, therefore, be filed after the simple number. For example, 547 will file before 547.40.

As the division of main classes follows a hierarchical pattern, a succession of digits interposed with decimal points make the meaning of a UDC number more and more restrictive. In other words, the base remaining the same, the longer the number, the more restrictive is the concept. In such a situation, shorter numbers will logically be filed before longer ones, e.g.

666.9	Gypsum, lime and cement industries
666.9.01	Chemical engineering. Principles and practice

- 666.9.015 Reactions. Behaviour of materials undergoing change  
 666.9.015.4 Setting reactions and changes generally  
 666.9.9.015.42 Reactions in mortar. Hydration. Hydrated compounds.

UDC class numbers are mostly numerical consisting of Arabic numerals. The arrangement (or filing order) of UDC numbers thus become mechanical, more so because decimal fractions possess an inherent ordinal value, e.g.

- 633.3 Forage plants except grasses.  
 633.4 Edible roots and tuber root crops  
 633.495 Taro colocasin esculenta  
 633.5 Textile and fibre plants  
 633.52 Flax and similar fibres  
 633.6 Sugar and starch plants  
 633.791 Hop. *Humulus lupulus*

"Non-numerical and other symbols are given an arbitrary ordinary value which are filed immediately after the symbol" (double quotation marks).

The following example will illustrate the filing order of simple and compound UDC numbers:

*Symbol Filing order*

- |               |  |  |
|---------------|--|--|
| =             | =40 French language                            | Independent auxiliaries may be used alone, and being general, will be cited first.   |
| (0 . . .)     | (0.027.3) Popular editions                     |  |
| (1/9)         | (44) France                                    |  |
| (=....)       | (=1.44) French nationals                       |  |
| " "           | "19" Twentieth century AD                      |  |
| +             | 629.76+929.76 Rockets and spacecraft           | Aggregation of several numbers has broader meaning than simple number, so the symbols + and / will file before simple number |
| /             | 629.734/.735 Heavier-than-air aircraft.        |  |
| Simple number | 629.76 Rocket                                  |  |
| :             | 629.76:620.1 Material testing for rockets (may | The symbols : and :: impart a more restrictive   |

	be reversed to form	concept than a simple
	620.1:629.76)	number. Hence these are
::	629.76 :: 620.1 Mate-	filed after simple numbers
	rial testing for rockets	
	(May not be reversed)	
=	629.76=40 Documents	With dependent auxili-
	in French about rockets	aries as suffixes, the
(0...)	629.76(0.027.3) Popular	concept gets more and
	edition of documents	more restricted, and are
	in French about rockets	consequently filed after
(1/9)	629.76(44) French rock-	colon and order-fixing
	ets. Race is not	symbol
	relevant here	
" "	629.76 "19" Rockets of twentieth century AD	
* A/Z	629.76 *Ariane	*Ariane rocket
.00	629.76.005	Installation of rockets
" "	629.76 "19" Rockets of twentieth AD	
" A/Z	629.76 *Ariane	*Ariane* rocket
.00	629.76.005	Installation of rockets
-0	629.76-057.21 Skilled workers	Special auxiliaries
	for rockets	denote the most
-1-9	629.76-752 Stabilizers for	restrictive meaning,
	rockets	and are filed at the
.0	629.76,017.3 Manoeuvra-	end followed by
	bility of rockets	the next simple
,	629.76,78 Rockets for space-	number.
	craft	
next	629.762 Missiles	
simple		
number		

Meanwhile, the implications that arise in terms of filing the entries (or documents) when more than one auxiliary is used need to be explained. For this purpose, the following example may be cited:

669 "17" Metallurgy—18th Century AD

669 (540) Metallurgy-India.

The citation of special and common auxiliary sub-divisions and symbols follows a reverse order in a UDC number for a compound or complex subject as will be evident from two

tables cited after the chapter 5. Following this principle, the common auxiliary for time will be preceded by that for place, e.g.

669 (54) "17" Metallurgy—India—18th Century AD

The filing order of these three UDC numbers will be as follows:

669 " 17" Metallurgy—18th Century AD

669 (54) Metallurgy—India

669 (54) "17" Metallurgy—India 18th Century AD.

This example indicates that by subordinating the time to place, a general-before-special sequence has been maintained.

A compound UDC number can be formed using colon as a facet indicator even when special auxiliaries exist for introducing the same concept. A few examples will clarify the point when special auxiliaries are used to formulate a number:

546.14-13 Gaseous bromine.

When colon is used the UDC number denoting the same concept:

546.14: 54-13 Bromine—gaseous state.

When this procedure is adopted in formulating UDC numbers, the filing order gets disrupted. In this connection, the order of filing of certain numbers may be cited:

When the compound number is formed with the help of special auxiliary, the filing order will be as follows:

546.14 Bromine

546.14.001.5 Bromine—research

546.14.001.5"18" Bromine—research—19th century

546.14.001.5"18"(035).Bromine—research—19th  
century—handbook on.

546.14.001.5"18"(035)=30 Bromine—research—19th  
century—handbook on  
German language.

546.14-13 Bromine—gaseous state.

546.15 Iodine.

But, when the compound number for the same topic is formed with colon, the filing order will be as follows:



546.14	Bromine
546.14 : 54-13	Bromine—gaseous state.
546.14.001.5	Bromine—research
546.14.001.5 "18"	Bromine—research—19th century.
546.14.001.5 "18" (035)	Bromine—research—19th century—handbook on
546.14.001.5 "18" (035)=30	Bromine—research—19th century—handbook on—German language
546.15	Iodine.

In this case, due to introduction of the facet indicator in place of special auxiliary, the precise facet (i.e. gaseous state) of the topic gets filed in the beginning. As a result, the general-before-special sequence gets disrupted. Some people use colon as a facet indicator in preference to special auxiliary for introducing multiple-entry system. This is done with the assumption that constituent numbers of a compound subject, related by colon, can be rotated whereby each number is brought forward by turn revealing its multiple facets. But numbers mean little to the users who have to be provided with an A/Z subject index to the classified file. But, the adoption of multiple-entry leads to an increase in the bulk of the classified file.

Having discussed the filing order, it is desirable to explain in detail what is meant by the single-entry and multiple-entry system.

The following UDC number may be considered:

621.039.543.6:62-526:62-11 General design of servo-controlled machines for operating plutonium fuel.

In a multiple-entry system, the components of the UDC number is rotated to enable each of them to become a three point by turn, e.g.

621.039.543.6:62-526:62-11  
 62-526:62-11:621.039.543.6  
 62-11:621.039.543.6:62-526

In fact, a permutation of 3 components will result in six UDC numbers. In this example, the permutation is selective resulting in the citation of only entry entries.

Thus, if the components of the UDC number is considered as A : B : C, then the pattern of cited entries assumes the following form:

A : B : C

B : C : A

C : A : B

The multiple-entry system is sometimes adopted for maintaining more than one classification to counteract the scattering of subjects in an A/Z index to classified file.

The multiple-entry system may not be used due to following drawbacks: the selection of a few among all possible permutations is an arbitrary practice; class numbers get lengthened in direct proportion to an increase in the number of coloned components; classified file gets enlarged, and the 'general-before-special' principle of the filing order gets disrupted.

In contrast, the UDC number gets shortened when special auxiliary subdivisions are used to denote the same concept, e.g.

621.039.543.6-526-11    General design of servo-controlled machines for operating plutonium fuel.

In a single-entry system, the topic gets only one entry in classified file. With the same topic, there will be three entries for a multiple-entry system. This is more economical than single-entry system. The following example will illustrate the point:

In a single-entry system, this topic gets a class number with one entry in the classified file, e.g.

621.039.543.6-526-11

But in a multiple entry system, the same subject is denoted by a class number wherein the elements have been joined by colon, i.e.,

621.039.543.6:62-526:62-11



Now, the final digits . . . 13 listed under 539.12 denoting 'decay' can be added to 539.125.4 'proton' to form the following number:

539.125.4.13 Proton decay

It may be noted that the three points have been replaced by the digit 541. In this particular number, repunctuation of the digits has not been necessary because the transition from the 'elementary particle' facet to 'decay' facet takes place after the seventh digit and is not marked. But punctuation after every third digit becomes necessary in certain cases, as will be evident from the following example:

661.86 Aluminium compounds

The special auxiliary subdivision . . . 22 'Oxide' is added to it resulting in the following number:

661.8622 Aluminium Oxide.

This number has to be repunctuated in the usual manner as follows :

661.862.2 Aluminium Oxide.

### **Parallel division**

The UDC (1985) schedule is replete with the sign at numerous places. This sign has wide ramifications and use. Apart from special auxiliaries, its application has been extended to main numbers and common auxiliaries. Parallel divisions are possible with auxiliary numbers drawn from main numbers, and also main numbers derived from auxiliary numbers; a number may also serve as the source number for the parallel division of its own subdivisions.

The sign  $\approx$  signifies parallel division, and indicates that the subdivisions of the number following the sign can be used to formulate new numbers which are not present in the schedule. This is done by taking some digits from the end of this number (known as the source number) and adding them to the number preceding the sign  $\approx$ . This number is known as the target number. The significance of this parallel division will be apparent from the following example:

631.3.01  $\approx$  629.11.01

The source number 631.3.0.1 denotes 'vehicle' components except power units of agricultural machines, implements and equipments while the target number 629.11.01 indicates 'part of the vehicle other than the 'engine' of land vehicle engineering (except rail vehicles), road vehicles.

Now, suppose a number has to be formulated for the following subject:

Frames of caterpillar tractors.

The UDC (1985) schedule contains no such number; and so the number has to be built up with the help of parallel device. It may be noted that only the enumeration of the source number starting from 629.11.01 has to be scanned to find an appropriate number for affixing its end digits to 631.3.01 for arriving at the desired number:

The number 629.11.01 has been enumerated as follows:

- 629.11.011 Chasis and body
- .011.1 Chasis in general
- .011.11 Rigid chasis, Frames.

As the term 'frames' occur at 629.11.011.11, the end digits which precedes 629.11.01 will serve the purpose.

The number for the 'caterpillar tractors' is 631.3.072 to which the digits 111 will be added resulting in the following number:

- 631.3.072.111 Frames of caterpillar tractors
- from 631.3.072 caterpillar tractors.
- and 629.11.011.11 Frames.

Thus the transition of selected digits from the source number to the target number helps to formulate numbers which, besides being short, are co-extensive with the subject.

Using this method, numbers, which have not been enumerated in this UDC schedule, can be formulated to denote many subjects, compound and complex.

Some more examples are given showing different uses of the parallel division:

Now, an example of parallel division with main numbers is cited below:

656.35 $\rightleftharpoons$ 625-5

Let it be assumed that a number has to be formulated for the following subject:

Transport by aerial cableway system.

This subject has two aspects, i.e., transport service and transport engineering. Both these aspects have to be represented through a number. The problem envisages that the enumerated schedule has to be scanned to locate a number which is a subdivision of 625.5 and denotes aerial cableway system, e.g.

625.576.3 Monocable system (single suspension and traction cable).

The end digits 763 which precedes 625.5 have to be lifted and added to the number 656.35 to yield the following number:

656.357.63 Transport by aerial cableway system.  
 from 656.35 Transport by aerial ropeways and cableways.  
 and 625.576.3 Monocable system (simple suspension and traction cable).

An example of parallel division of common auxiliaries is given below:

"468"  $\cong$  "453"

The subdivision of the source number proceeds as follows:

"453.1" Duration of 1 millennium (1000 years)

"453.225" Duration of 2.25 millennium (2250 years)

Hence, the target number can be subdivided as follows:

"468.1" Age of 1 millennium

"468.225" Age of 2.25 millenniums

Such parallel divisions can be used to denote the precise aspect of time facet, e.g.

294.118 "453.4" Hindu sacred books dating back four millenniums.

An example of parallel division of auxiliary numbers derived from main numbers is given below:

032.8  $\cong$  553.8 (except—32.89)

The subdivision of the source number proceeds as follows:

553.81  $\cong$  Diamond deposits

553.84  $\cong$  Topaz deposits

Therefore, the target number can be enumerated as follows:

-32.81          Diamonds

-32.84          Topaz

As the number-03 stands for common auxiliaries of materials, such parallel divisions can be used to denote the precise aspect of a subject, e.g.

671.121.3-32.81      Diamond bracelets

671.121.5-32.84      Topaz ring.

An example of the parallel division of main numbers derived from auxiliary numbers is given below:

974/979  $\cong$  (74/79)

Further subdivisions of the source number are as follows:

(752)      Maryland

(798)      Alaska

Then, the numbers for the history of these regions will be as follows:

975.2      History of Maryland

979.8      History of Alaska.

Also, the numbers for the geography of these areas will be as follows:

917.52      Geography of Maryland

917.98      Geography of Alaska.

Now, an example is given below wherein a number serves as the source number for the parallel division of one of its own subdivisions, e.g.

659.28  $\cong$  659.2

To illustrate the use of such parallel division, the following topic may be considered:

Inquiries for information on economic intelligence and advice.

The UDC (1985) schedule contains no readymade numbers for this topic. The number has to be fabricated with the help

of parallel division. While applying the parallel division, the classifier is usually faced with the problem as to what digits have to be lifted from which subdivision of the source number for adding to the target number.

This is how it is done. In this case, the subdivision 659.231 has to be selected because it denotes "economic intelligence" which is relevant to the subject under consideration. The number 659.2 is common both to 659.231, a subdivision of the source number 659.2, and target number 659.28. The digit 31, which occurs at the end of this common number 659.2, has to be added to the target number for arriving at the desired number. Thereafter, the repunctuation is done by placing the dot after every third digit, e.g.

659.283.1	Inquiries for information on economic intelligence and advice.
from 659.28	Inquires for information.
and 659.231	Economic intelligence and advice.

It may, however, be noted that repunctuation is not needed when the source number and target number have equal number of digits, e.g.

$$622.67.05 \cong 621.85.05$$

The parallel division will be useful for the classification of certain subjects which have no ready made numbers in the enumerated schedule. For example, the following subject may be considered:

Flexible transmission by driven pulleys.

From the enumerated schedule, the subdivision 621.85, 051.34 of the source number may be selected because it contains the term 'driven pulleys'. In this case, the digits 05, which occur at the end of 621.85.05 and 622.67.05, are common to both numbers. This 05 may be considered as the cut-off point, and digits which occur after 05 in the source number have to be lifted and added to the target number to arrive at the desired number of the subject, e.g.

622.67.051.34	Flexible transmission by driven pulleys.
from 622.67.051	Driven pulleys.
and 621.85.051.34	Flexible transmission.



The methodology for restructuring the number needs to be explained through more examples. The restructuring becomes necessary when numbers, which are non-existent in the schedule, have to be synthesised with the help of parallel division, and the target number and source number are of unequal length.

The following example of parallel division may be considered:

$$542.6 \approx 66.06$$

The subdivision of 66.06 proceeds as follows:

66.061.1      Solution (dissolving) in general.

66.061.35     Extraction from liquids.

66.063.72     Softeners, plasticizers and their use.

Imagine that the point is removed from these subdivisions which then assume the following form:

660611

6606135

6606372

Now, imagine that the point is removed from the target number which then assumes the form 5426, i.e., the number consists of four digits. So, the end digits after the fourth digit (as shown above) are an important factor.

After adding these end digits, the subdivisions without dots will acquire the following forms:

542611

5426135

5426372

For restructuring, dot has to be put after every third digit. Thereafter, the numbers are finally presented as follows:

542.611      Working with solutions (dissolving) in general.

542.613.5     Working with extractions from liquids.

542.637.2     Working with softeners, plasticizers, and their use.

The wide ranging use of common and special auxiliaries and various devices impart a vast degree of flexibility to the UDC scheme, which, though confined to a limited number of pages, is useful for identifying an unlimited number of topics, and can, therefore, be termed as truly 'universal'.

It may be noted here that the concept of parallel division is not new to the UDC (1985) schedule. It had been present, though less frequently, in the form of instructions 'subdivide as' in the earlier UDC BS 1000A (1961). For example, the following instruction appears at 621.11 of this schedule:

629.11.02/.07      Subdivide as 629.1.02/.07

With the help of this device, the following number can be formulated:

629.11.02/074	Road-worthiness of land vehicles
from 629.11	Land vehicles
and 629.1.074	Road-worthiness

As the old schedule is not being discussed, such examples need not be multiplied. But, suffice it to say that the instruction 'subdivide as' is equivalent to the parallel division  $\approx$  of the latest schedule (1985).

Different signs used in the Universal Decimal Classification and their significance have already been given. All these have been presented in a summarised form in table 1.

TABLE 1

<i>Auxiliary Tables of UDC</i>		
Common auxiliary signs		
+	(plus)	for coordination, addition
/	(stroke)	for consecutive extension
:	(colon)	for relation
::	(double colon)	for order-fixing
Independent auxiliary signs		
=		Language
(0 . . .)		form
(1 / 9)		place
(= . . .)		race
" . . . "		time
Special auxiliary signs		
-1/-9	hyphen series	denote recurring concepts
.01/.09	point-nought series	
'1/9	apostrophe series	
Dependent auxiliary signs		
.00		Point of view, materials and persons
* asterisk		means of adding non-UDC notations

### 3

## Classes and Characteristics

### DDC and UDC

Before proceeding to discuss the peripheral aspects of the UDC, some of the characteristics and special features of its main tables deserve attention.

Melvil Dewey had formulated the Dewey Decimal Classification (DDC) in 1876. In it, the universe of knowledge had been divided into ten distinct disciplines. These divisions, propounded by Melvil Dewey, may appear to be somewhat arbitrary. The fifth edition of the DDC had formed the base on which the UDC had been built. Till this day the division of classes in both the classification systems remains unaltered.

The DDC has now been run into 19th edition (1979) since its inception in 1876. During this period, its format has undergone changes a few times. The present edition comprises three volumes, i.e. introduction tables, schedules and relative index. The main difference between the DDC and UDC lies in the fact that the main classes in the former consists of three digits, while in the latter, it is two digits. The DDC has three auxiliary tables. In the UDC, the auxiliaries are many with multiple uses and approaches, details about which have already been given in chapter I.

It has often been said that the number of classes in the DDC could have been more, and better aligned. In spite of the narrow base, the ingenious feature of the DDC is that the decimal system allows the classes to be divided and subdivided to any extent. Besides, the provision of connective and rotational symbols, common and special auxiliaries help to formulate UDC numbers for all possible subjects for practical purposes. In the next few pages, a brief outline of

nine main classes of the Universal Decimal Classification will be given. The outline will include appropriate examples to show the methodology for the formulation of class numbers for a number of compound subjects which are inter-disciplinary in nature. Different facets of a compound subject are brought into focus with the help of special auxiliaries. The formidable array of these auxiliaries need not deter the users who will get used to them with a little effort. Thereafter, practical classification becomes quite interesting and absorbing. The methodology for classification of complex subjects will be discussed at a later stage.

By this time, the user has come across certain terms like class, subclass etc. Although the meaning of these terms are apparent, their connotation need to be given before the user studies further implications of the classification practice. The connotations are as follows:

**Class**—These are main tables with primary notation existing in the form of single-digit classes. The UDC schedule (1985) contains nine classes (0-9) wherein the class 4 now has been vacant. The example of a class is 5 Mathematics and Natural Sciences. **Subclass**—Each of the ten theoretical classes (or nine occupied classes) are divided to form ten narrower classes (or subclasses). These are two-digit classes, e.g. 51 Mathematics.

**Subdivisions**—These are three-digit numbers derived from two-digit subclasses, e.g. 514 Geometry.

**Simple number**—A number, whether a main number or an independent auxiliary, when taken from a single place in the tables and cited on its own, is a simple number, e.g. 517.5 Theory of functions.

**Compound subject**—In a compound subject, more than one element within a conventional class gets reflected within it. A compound subject can accordingly be represented by a number, e.g.

Materials handled by transporter cranes 621.86:621.875.1

**Compound number**—It is a number created by synthesis, using elements from more than one place in the table, e.g.

681.883.4.04      Range of sonar equipment.

**Complex subject**—In a complex subject, elements from more than one distinct conventional class are reflected within it. A complex subject can be represented by a class number, e.g.:

Costing with luminous paints 667.637.4.628.9.03

**Complex number**—Such a number is created by synthesising, using elements from more than one distinct conventional class, e.g.

663.152.3 Industrial fermentation by hydrolysis

**Auxiliary tables**—Often denoted by the term 'Tables', these contain signs and subdivisions which allow for the construction (or synthesis) of compound numbers, e.g. Table 1(d) Common auxiliaries of form.

**UDC Schedules**—When any mention is made about the UDC schedule (1961) in this book, it refers to the UDC Abridged English edition. BS 1000A:1961. Ed.3, revised 1961 (FID Publication No. 289).

The UDC (1985) schedule will mean the Universal Decimal Classification. International Medium Edition. English text. BS 1000 M: Part 1: 1985 (FID Publication No. 571), which is the latest schedule now in existence.

Also, the term 'number' will mean UDC Class number.

### **Description of classes**

The descriptions of nine main classes (0 to 3 and 5 to 9) are given below:

O Generalities, Science and Knowledge Organisation. Information, Documentation, Librarianship, Institutions, Publications.

It will be apparent from the heading that the main table O denotes such general topics which are not consistent with the other eight classes that follow it. Some of the numbers in this table may look similar to those which have been enumerated in other classes of this schedule. But this apparent similarity is unreal. There is always a basic difference, for example, the concept represented by the number '001 Science and Knowledge in general' is different from '50 Generalities about

the pure science'—the former is concerned mostly with literary approach to the subject, while the latter number and its subdivisions relate to the management of scientific problems.

As the user gets himself acquainted with the schedule, he will notice that special auxiliary subdivisions follow principal divisions throughout the main tables. These auxiliaries provide various shades of meaning, which when aligned with principal divisions in a prefixed manner, helps to formulate numbers for specific compound subjects. For example, any ready-made number for the subject 'Characteristics of prehistoric scripts' has not been given in the table. So, this class number has to be synthesised from the table. This can be done with the help of a number from the principal division and another from the special auxiliary subdivisions that precede it, e.g.:

	003.315.08	Characteristics of prehistoric scripts.
from	003.315	Prehistoric scripts.
and	003.08	Characteristics of scripts.

Another example is given below:

	006.3.05	Creation of national standards for printing.
from	006.3	National standards.
and	006.05	Creation of standards.

An unusual phenomena can be represented by 001.94, e.g.:

	001.94(1-925.36 YET)	Yeti, the abominable snowman of the Himalayas.
from	001.94	Reported phenomena not yet fully explained.
and	(1-925.36)	Himalayas.

The non-UDC number 'YET' stands for the Yeti, the mysterious creature which is often reported to inhabit the north-eastern Himalayas at high altitudes, but not yet encountered.

If the special aspect of this number has to be made more specific, then the common auxiliary (1-18) which denotes 'north-eastern' can be added to the number, e.g.:

	001.94 (1-925.36-18 YET)	Yeti, the abominable snowman of the north-eastern Himalayas.
--	--------------------------	--

Special auxiliary subdivisions help to make the table concise through subdivisions of an existing number and addition of digits from it. This feature can be explained with the help of the following example:

The class number 06.043, a subdivision of the number 06, can be subdivided like 06.02, e.g.:

06.043.637 Honorary members of advisory committees.

The class number has been formulated by the addition of digits 37 to the number 06.043.6, i.e.:

from 06.043.6      Advisory committees

and 06.023.7      Honorary members

### **1. Philosophy and Psychology**

The table on philosophy and psychology has been enumerated upto 179.9, leaving the gap to be filled up by subjects which may emerge later.

All numbers are enumerated in this main class with the absence of any instruction for parallel divisions. But, this class abounds in numerous arrow marks which advise the user to consult other classes—mainly class 2 and 3. This makes the fact apparent that philosophy and psychology are closely associated with religion, social ethics and related concepts. As usual, this class has a bias towards philosophy of western countries. Nevertheless, it is possible to draw up a special classification scheme based on oriental philosophy. There exists enough scope for it in the schedule. But, it is beyond the scope of the present treatise.

### **2. Religion and Theology**

A major part of this class is devoted to Christian religion which is but natural because this system of classification had been developed in the West. Numbers for Christianity have been given in detail, i.e., upto 289.957, and other religions accommodated in an area ranging from 29 to 299.992 leaving limited space for non-linear expansion. However, those who want special classification schemes on non-Christian and other religions may compile one by the application of 'subdivide as' device, and then further specification by non-UDC notation.

Some examples based on "294 Hindu religion" are given below:

294.11  $\cong$  291

This parallel division helps to formulate the following number:

294.214	Gods' of Hindu religion.
from 294.11	Vedism (Hinduism).
and 291.214	Gods

The names of all divinities of Hindu religion can thus be obtained by parallel division from the same source number, e.g.:

291.214	BRA	Brahma
291.214	VIS	Vishnu

Many other facets of a religion (i.e. sages, hermits, interpreters of divinity etc.) can also be denoted by UDC number through parallel division, e.g.:

294.11 $\cong$ 291.61	
whereas 294.116.1	Hindu priests
294.116.2	Yogis
294.116.3	Sages
294.116.3 VYA	Vyasdeva, the sage
294.116.4	Interpreters of divinity
294.116.4 AUR	Sri Aurobindo, the seer.
294.116.5	Holi orders
294.116.5 RKM	Ramakrishna Mission.

Similarly, parallel division can be used to classify religious books and scriptures of Hindu religion, e.g.:

294.118	Sacred books.
294.118 RIG	Rig Veda
294.118 GIT	Bhagawat Gita
294.118 RAM	Ramayana.

Examples can be multiplied to any extent.

To many, the specification by non-UDC notation may not appear to be a satisfactory system of classification for non-Christian and other religions, but this device at least helps to organise different aspects of any particular religion or faith in a systematic order.





The fact that the UDC schedule does not give wide coverage to subjects like philosophy, psychology and religion cannot be denied. So, those who want to go into details of these subjects may consult the Dewey Decimal Classification schedule. The UDC schedule is mainly concerned with scientific and technical subjects which get extensive representation in it.

**3. Social Sciences; Statistics; Politics; Economics; Trade; Law; Governments; Military Affairs, Welfare; Insurance; Education; Folklore.**

In the main class 3, the numbers have been enumerated upto 398.9 leaving little scope for non-linear expansion. But, the profusion of point-nought series .01/.09 of special auxiliaries enables one to formulate number for wide range of subjects. Besides, end digits from the array can be added to enumerated numbers yielding numbers for compound subjects, e.g.

	321.72.019.52	Public opinion poll in parliamentary democracy.
from	321.72	Parliamentary democracy
and	32.019.52	Ascertaining public opinion.

Numbers from the table 1(g) common auxiliaries of time and those from table 1(h) specification by non-UDC notation may be used with the numbers at 329 to denote "political parties and movements", e.g.

329(540) INC	Indian National Congress
329 (54) CPI	Communist Party of India
329 (73) REP	Republican Party of USA.

To denote parties and movements of a particular country, the common auxiliary of place and apostrophe are brought into use, e.g.

329(43)-14'17 Nationalist socialist movement in Germany.

An interesting aspect of the number 355/359 is that any subdivision of it can be combined with any other of its subdivision to form compound numbers with the help of a hyphen auxiliary. This hyphen auxiliary is formed by replacing the digits 35 from 355/359. The following examples will illustrate the formation of such class numbers, e.g.:

356.168-525.3 Training of commandos.

from 356.168 Commandos  
and 355.253 Training

The number has been obtained after eliminating the digits 35 from 355.253 and affixing the rest to the base number 356.168 by hyphen auxiliary.

This subject can also be represented by the number 355.253-616.8.

Another example of similar nature may be cited:

356.118-811.6 Anti-tank artillery for assault troops.  
from 356.118 Assault troops  
and 358.116 Anti-tank artillery

The subject can also be denoted by the number 358.116-611.8.

The class numbers 355/359 may appear to have some common features with 623, but the applicability of one is at variance with the other. The class number 355/359 is concerned with "Military affairs. Art of war. etc." while 623 deals with military engineering, i.e. technical aspects of equipment for warfare.

But, when it is desired to indicate the defence measures using military hardware, subdivisions of the class number 355/359 and 623 can be brought together by colon to specify the target aspect, e.g.

355.457:623.462.2 Defence of land frontiers using  
surface-to-air missiles.  
from 355.457 Defence to land frontiers  
and 623.462.2 Surface-to-air missiles

The number 355.457: 623.462.2 deals with the defensive aspect of the art of war. This subject is a complex one.

The alternative number which denotes the military hardware for assault purposes will be as follows:

623.462.2:355.457 Surface-to-air missiles for defence  
of land frontiers.

Another interesting feature of this table centres around the class number 372, and its sub-divisions, e.g. 372-8  $\approx$  0/9. This implies that the parallel division can be effected from any

part of the entire UDC table, i.e. 0/9. The following example will illustrate the point:

	372.850.23	Environmentology
from	372.8	Other subjects (special subjects) as the content and curriculum in pre-school and elementary education etc.
and	502.3	Nature study. Nature conservation and protection in general.

At 378.6, an instruction appears for the parallel division 378.6  $\approx$  0/9. The number for any subject based on the target number 378.6 can be formed with its help, e.g.

	378.657	College of business management
from	378.6	Education of particular social groups.
and	658	Business management.

There is no need to give more such examples because it is presumed that by going through the table itself, the users will know the implications and methodology of formulation of numbers relating to class 3 and beyond.

#### 4. Class

The class 4 has been kept vacant. It will be allotted to some fast developing subject. The Central Classification Committee (U.K.) had submitted a number of proposals relating to revision of the UDC for the FID Conference held at the Hague in 1964. One proposal deserving special mention is that the main class 4, liberated since June 30, 1964, will be used to accommodate subject fields which have a bearing on pure and applied sciences (classes 5 to 7). It may possibly be information and communication sciences and general energy problems.

In the UDC schedule (1961) class 4 had been assigned to philology, linguistics and languages with an instruction that linguistics and languages may be classed with literature at 8.07. As this book is not concerned with the UDC schedule (1961), the implications resulting from the implementation of the proposal contained in it need not be recounted here. The fact that 'literature and *belles-lettres*' had been relegated to class 8 had invited critical comments for keeping apart class 4 and 8 which were considered to have an affinity. This lacunae

has now been bridged in the UDC schedule (1985) wherein class 8 encompasses language, linguistics and literature. The significance of the merger of class 4 with class 8 will be explained when subjects belonging to class 8 is taken up for discussion.

## 5. Mathematics and Natural Sciences

The class 4 includes mathematics, astronomy, astrophysics, space research, geology, physics, chemistry, mineralogical sciences, earth sciences, meteorology, biological sciences, botany, and zoology. The subdivisions range from 5 to 599, thereby implying the possibility of expansion of their subdivisions to accommodate the related subjects that may hereafter emerge.

Special auxiliary subdivisions with all the three kinds of notations have been used in different places of this class. The mode of application of these auxiliaries will be explained through some selected examples. One such example is given below;

	523 47.87	Satellite of the Uranus.
from	523.47	Uranus
and	52.87	Satellites.

The final digits, i.e., digits with three points...1/...9 have been used as special auxiliary subdivisions at 539.12. The application of this device has been discussed before. Its direct application under this particular subdivision may be explained through the following examples:

	539.125.561.4	Spin and moments of antineutrons
from	539.125.56	Antineutrons
and	539.12...14	Spin and moments

Another example of similar nature is given here:

	539.144.164	Energy spectra of nuclei in the excited state
from	539.144	Nuclei in the excited state
and	539.164	Energy spectra

Theoretical aspects of nuclear physics, atomic physics and molecular physics have been enumerated under the class

539, while engineering and technical versions of these subjects are represented at 621.039 and its sub-divisions, e.g.

539.183.2 Properties of isotopes.

631.039 Application of isotopes.

The subdivision 546 Inorganic chemistry belonging to the division 54 needs elaboration, specially for those who are not familiar with chemistry as a subject.

Inorganic chemical compounds are represented by UDC numbers which are formulated with the help of special auxiliary subdivisions belonging to the category of apostrophe series '1/9. The principle which underlies it is that the chemical compounds are formed from the reaction between two or more chemicals. For the sake of simplicity, it is accepted that when two oxides react with each other, or when an oxide reacts with a hydride, a chemical compound is formed. At this stage, it may be noted that the oxide is a binary chemical compound in which oxygen is combined with a metal (such as  $\text{Na}_2\text{O}$ , basic) or nonmetal (such as  $\text{NO}_2$ , acidic), and a hydride is a compound containing hydrogen and another element. An example of the latter is  $\text{H}_2\text{S}$ , which is a hydride although it may be properly called hydrogen sulfide, and lithium hydride,  $\text{LiH}$ . The method for the designation of a chemical compound becomes easy when it is understood that its class number depends on the oxide or hydride radicals which are reacted to form the compound. A metal radical (cation) is combined with an acid radical (anion) to form a binary compound. The number for such a compound is formed by adding the number for the acid radical to that of the metal radical and replacing the digits of the former by an apostrophe, e.g.:

546.48'221	Cadmium sulphide
from 546.48	Cadmium
and 546.221	Sulphides
Also, 546.33'131	Sodium chloride
from 546.33	Sodium
and 546.131	Chlorides

Sometimes, several metallic radicals (cations) or acid radicals (anions) are contained in a chemical compound. Such

a compound is represented in the following manner. The metal which has the highest numerical order is cited first, and the numbers for other metals and those for acids are added to it in reverse numerical order, e.g.

546.76	Potassium
546.32	Chromium
546.226	Sulphate

The numbers 546.32 and 546.226 can be added to the metal 546.76 to formulate the following class number for an alum:

546.76 '32' 226, 24H<sub>2</sub>O Potassium Chromium alum

The non-UDC auxiliary 24H<sub>2</sub>O has to be added because the chemical formula for this alum is K<sub>2</sub>SO<sub>4</sub>, Cr<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>, 24H<sub>2</sub>O

The derivations of non-metals and metalloids in general can be denoted by special auxiliaries 54-1/-48, and parallel divisions. With the help of one such parallel division 546.18≈546 17, the following numbers can be derived, e.g.:

546.183-31	Phosphorus oxide, P <sub>2</sub> O <sub>3</sub>
from 546.18	Phosphorus
and 546.173-31	Nitrogen trioxide, N <sub>2</sub> O <sub>3</sub>

Further derivatives of phosphorus can be obtained by the same methodology, e.g.

546.183-131	Phosphorus trichloride
546.185-31	Phosphorus pentoxide
546.185-323	Phosphoric acid.

The special auxiliary -31 is affixed to the base number to denote simple oxides, e.g.

546.41-31	Calcium oxide
from 546.41	Calcium
and 54-31	Oxides

The special auxiliary subdivision .027 listed under 54 is used to denote isotopes of elements. The phenomena arises from the fact that although all the atoms of the same element contain the same positive charge, they may or may not contain the same number of neutrons. As the atomic weight of an element is equal to the combined masses of protons and neutrons present in the nucleus of the atom of that element,

the atoms of the same element may have different masses, although possessing the same net positive nuclear charge. It, therefore, follows that two or more specimens of the same element having the same number, and having the same net positive nuclear charge but having different atomic weights due to their containing different number of neutrons are called isotopes.

The method for allotting class number to an isotope is simple, e.g.

546.841.027	Thorium isotope
from 546.841	Thorium
and 54.027	Isotopes

An asterisk and mass number can be added to denote an individual isotope, e.g.

546.791\*234<sup>234</sup>U

The mass number, as mentioned above, is the sum of the numbers of protons and neutrons in the nucleus of an atom or or nuclide. It is also known as the nuclear number.

The element carbon forms such a large number of compounds that a special branch of chemistry, known as the 'organic chemistry' has been created to deal with them. More than a million organic compounds are known to the modern chemist. A large number of such major compounds can be denoted by the UDC numbers which itself is a remarkable achievement of the compilers of the UDC scheme. The classification of organic chemical by UDC numbers is useful for technical processing of documents dealing with such compounds. Although of limited utility, the exercise in formulating numbers for organic chemical compounds is nevertheless a matter of profound academic interest. It is, therefore, proposed to cite a number of examples to show how special auxiliaries using three kinds of notations are employed for denoting organic compounds. It may be noted that the apostrophe series '1/9, which are synthetic or integrative in function, have been extensively used, while the other kinds, i.e. hyphen series-1/9 and point-nought series .01/.09 are utilised in a limited way. Examples showing the use of all three kinds of notation are given below:

An organometallic compound  $\text{CH}_3\text{MgI}$  is a monosubstituted derivative of saturated hydrocarbon. The synthetic function of the special auxiliary using apostrophe notation helps to unite digits from the numbers 546 and 547 to yield numbers for organometallic compound. The following example may be seen:

547.254.6'115.1'2 11 Methyl magnesium iodide  $\text{CH}_3\text{MgI}$

The base number 547.254.6 has been derived through the following stages:

547.254.6	Magnesium derivative of saturated hydrocarbon
from 547.25	Monosubstituted organometallic derivatives of saturated hydrocarbons.
and 547.46	Magnesium

Then, the following digits are obtained with the help of parallel division  $'11/16 \cong 546.1/.9$  and the following numbers:

'1151	Substituted for iodide
from 547.1	Organic chemistry in general
and 546.151	Iodide (derived from 546.15 with the help of parallel division $546.15 \cong 546.13$ )

Thereafter, the following digits are obtained through the following process:

'211	substituted for methyl group
from 547.211	methane

Finally the digits 1151 and 211 are added to the base number 547.254.6 with the help of auxiliary with apostrophe sign.

An ester is a compound formed by the elimination of water and bonding of an alcohol and an organic acid. The numbers for esters, derived from saturated monohydric alcohols, can be formulated with the help of auxiliary using apostrophe sign and parallel division  $'11/19 \cong 546.1/.9$ , e.g.

546.271'11	Esters, or acid derivatives in general
from 547.261	Methanol $\text{CH}_3\text{OH}$
and 546.11	Hydrogen.



Following the principle of parallel division, numbers for more such chemical compounds, e.g. organometallic compound containing phosphorus, can be obtained:

547.261 '11 '118	Esters of acid containing phosphorus.
from 547.261 '11	Esters, or acid derivatives in general.
and 547.1 '118	Organometallic compound containing phosphorus

Esters are also formed with organic acids, e.g.

547.426.24 '117	Nitroglycerine $C_3H_5(ONO_2)_3$
from 547.426.24	Esters of inorganic acids.
and 547.1 '117	Nitrogenous organic compound (the number for this compound has been derived with the help of the parallel division '11/ '19 $\approx$ 546.1/.9).

Thereafter, the digits 117 have been added to the base number 547.426.24 with the help of auxiliary with apostrophe sign.

Esters are also formed when saturated monohydric alcohols are reacted with monobasic saturated carboxylic acids, for example, ethyl alcohol and acetic acid will react to form ethyl acetate. This end product can be represented by the following UDC number:

547.292 '262	Ethyl acetate
from 547.292	Acetic acid
and 557.262	Ethyl alcohol

An example of the use of special auxiliary with hyphen notation is given below:

547.422.22-31	Ethylene oxide
from 547.422.22	Ethylene glycol (ethanediol) $C_2H_6O_2$
and 54 -31	Oxides

It is obvious that the digits 31 have been added to the number for ethylene glycol with hyphen auxiliary.

Special auxiliary subdivisions with point-nought notation can be used to denote a specific aspect of the compound, not related to its composition, for example,

547.1 '128.05	Production of silicons
from 547.1 '128	Silicons
and 54.05	Production.

An organic chemical compound can be denoted by the addition of its condensed formula directly to 547, e.g.

547 C <sub>2</sub> H <sub>5</sub> O	Ethanol (Ethyl alcohol).
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Thereafter, main classes 548/549 have been allocated to mineralogical sciences, crystallography, mineralogy and matters common to 548 and 549.

An example showing the application of special auxiliaries with notations belonging to hyphen series and also point, nought series is given below:

549.21-114.061	Qualitative investigation of synthetic diamonds.
from 549.21	Diamonds
and 54 -114	Synthetic material
and 54 '61	Qualitative investigation

The division 55 relates to earth sciences, geology, meteorology etc. The class number 553 and its subdivisions represent an important aspect of these sciences, i.e., economic geology and mineral deposits. So, it becomes necessary that an example be cited showing how two common auxiliaries of place and space in general can be merged for denoting the location of mineral deposits. The example is given below:

553.98(267.64.03)	Oil and gas deposits in Bay of Bengal
from 553.98	Oil and gas deposits
and (267.64)	Bay of Bengal
and (26.03)	Depths of the sea. Submarine.

The division 56 relates to Palaeontology, and 57 to Anthropology. The class 58 Botany extends upto 582.999 leaving sufficient scope for non-linear expansion, if such a need arises.

An example showing the application of special auxiliary subdivision may be given, e.g.

582-1 $\approx$ 581
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With the help of parallel division of the source number, numbers for compound subjects can be easily formulated, e.g.

582.526.32-1	General botany of aquatic formations
from 582.526.32	Aquatic formations
and 582-1	General botany.

The UDC classification of zoology follows almost the same pattern as botany. For example, parallel divisions of the source numbers are helpful in formulating compound numbers, e.g.

591-2/-9  $\approx$  592/599

In this case, 592/599 systematic zoology equivalent to 592+592...+599 is the target number.

With the help of parallel division  $591-2/-9 \approx 592/599$ , it is possible to formulate compound numbers showing physiological aspects, e.g.

This implies that the entire range of target numbers from 591 to 599 can have numbers arising from parallel division of 592/599 added to them, e.g.

599.9.122	Cutaneous respiration of humans
from 599.9	Humans
and 591.122	Cutaneous respiration

The instructions for parallel division of the following class number may be considered:

592/599-1 $\approx$ 591	
597/598-121	General physiology of respiration of pisces and sauropoda
from 597/598	Pisces and sauropoda
and 591.121	General physiology of respiration.

The users may note that numbers for domestic animals have been located at 599.75 and also 636, but the aspects are different. The former relates to zoological study of animals, while the latter is concerned with their deployment in animal husbandry.

## 6. Applied Sciences. Medicine. Technology

The main class 6 is an extensive one in the sense that it

encompasses wide ranging subjects extending from 61 Medical Sciences to 69 Building (construction) trade, Building materials, Building practice and procedure. In between these, lie a plethora of disciplines comprising engineering, technology, agriculture and related sciences and techniques, forestry, farming, wildlife exploitation, housekeeping, home economics, domestic science, management and organisation of industry, trade and communication, chemical technology, chemical and related industries, various industries, trades and crafts, industries, crafts and trades for finished or assembled articles.

As all these subjects are equally important, each one of them will be taken up by turn and elaborated upon.

#### 61 Medical Sciences

There exist a profusion of parallel divisions throughout this class. To discuss each of them is not possible because it will expand the text without any perceptible benefit. Hence, only those parallel divisions which may pose problems to the classifiers will be cited.

Now, the following parallel division may be considered:

612.015.6  $\cong$  577.16

612.015.641

Effect and action of vitamin  
B complex

from 612.015.6

and 577.164.1

Effect and action of vitamins  
Vitamin B complex or group.

In some cases, instructions for parallel division as are given in the UDC schedule (1985) may not appear to be quite explicit to the users.

One such example is given below:

613.2-058  $\cong$  Table 1 (K)—058 (and  $\rightarrow$  616-058)

613.2-058.234.2 Nutrition of industrial workers.

from 613.2-058

Nutritional state of particular social  
classes.

and -058.234.2 industrial workers.

It suggests that 616 -058 be also referred to. Therefore, an example in respect of the number 616-058 and Table 1 (K) may also be given here:

616-058.6-54.73	Social incidence of disease of displaced persons.
from 616-05	Social incidence of disease
and -058.6	Victims of circumstances
and -54.73	Displaced persons

A similar example can be shown in respect of 614.8-05 wherein a number can be built up with the help of common auxiliaries from table 1 (K),

614.8-056.36	Accidents of mentally defective persons
from 614.8	Accidents according to persons injured.
and -056.36	Mentally defective persons

The sub-class "615.8 Physiotherapy etc.", is followed by the instruction that the -7 special auxiliaries listed under 616 are also applicable here. The idea behind it can be illustrated through an example, e.g.

615.814.1-72	Surgical and therapeutic instruments for acupuncture.
from 615.814.1	Acupuncture
and 616.72	Surgical and therapeutic instruments.

Earlier it has been stated that the parallel division proceeds at all levels. An example of the parallel division of special auxiliary -008 is shown below:

616 -008 1  $\cong$  616.008.6

The parallel division of 616.008.6 is explained through the following example:

616.008.263	Irregularity of pulse.
from 616 -008.2	Pulse
and 616-008.63	Irregularity

Another interesting example may be given here. In the UDC schedule (1985), instruction exists at 616-008.842/.848 for the application of parallel division of 611.2/.8 to the aforesaid number followed by a note within parenthesis, i.e., which, in turn, is roughly parallel with 616.2/.8. This simply means that the subdivisions of 611.2/.8 are almost identical with 616.2/.8.

As a consequence of this instruction, the following compound class number can be constituted:

616-008.842.25	Secretions of the pleura
from 616-008.842	Secretions of respiratory systems etc.
and 616.25	Pleura

The digits 25 of the number 611.25 have been added to the target number 616-008.842.

There are plenty of cases where compound numbers can be formulated by seeking source numbers even when no instructions exist for parallel division, e.g.

616.89-008.441-036.88	Terror of death
from 616.89-008.441	Terror
and 616-036.88	Death

## 62. Engineering, Technology in general

From what has been written so far, it is clear that coextensive numbers can mostly be formulated with the help of auxiliaries and parallel divisions. Out of these, the parallel divisions form the mainstay for building up class numbers. The UDC schedule (1985) abounds with these devices. Most of these are simple, and need no clarification. But there also exist instructions for certain parallel divisions which could be comprehended with a certain extent of explanation. So, as the class and subclasses are brought into focus, efforts will be made to select such 'not so easy' parallel divisions and provide explanatory notes supported by worked out examples.

Instructions for the parallel division exist at 621.039.67, and an example showing the formulation of an UDC number is given below:

621.039.67  $\approx$  621.039.57

Following the parallel division, the compound number for a specific topic can be formed, e.g.

621.039.676	Fusion reactor for heat generation
from 621.039.67	Fusion reactors
and 621.039.576	Reactor for heat generation

In such cases, the user should mentally eliminate the digits common to constituent UDC numbers, find out what digit is not common to them, and add this digit to the base number. In this case, the digit 6 is not common to them. So, this digit is added to the base number 621.039.67 resulting in the formation of the target number.

Now, an interesting example is being given where a number is the source for the parallel division of one of its own subdivisions, e.g.

621.178 $\cong$ 621

With the help of the parallel division, the following number is formed:

621.178.165.53	Breakdowns of superheated steam turbines
from 621.178	Breakdowns
and 621.165.53	Superheated steam turbines

It is evident that the digits 16553 have been taken from the number 621.165.53, and added to the base number 621.178 while care has been taken to ensure that the point occurs after every third digit.

As stated before, the UDC schedule (1985) contains numerous instructions for parallel divisions in all its classes and subclasses. Most of these instructions are easily comprehensible and need no further elaboration. So, only those cases which may not be quite explicit to the users are explained here through appropriate examples.

It has been mentioned at 621.365.036 that the details of individual parts of electric heating apparatus may be taken from 621.3.036...

Following this instruction, compound numbers can be formulated, e.g.

621.365.036.1	Electrodes of an electric heating apparatus
from 621.365.036	Individual parts of electric heating apparatus
and 621.036.61	Electrodes

It may be noted here that the digits 61, being common to

both these numbers, only the digit 1 has been taken out of 621.3.036.61 and added to the base number 621.365.036. Thus, the elimination of common digits also ensures the brevity of class numbers.

The following instruction at 621.643-03 may be noted. It says that the details from table 1 (K) -03 may be added to the aforesaid number to formulate compound numbers. The following example illustrates the point:

621.643.53—033.63	Stoneware troughs
from 621.643.53	troughs
and —033.63	Stoneware.

The users are now aware that a number may be the source for the parallel division of one of its own subdivisions.

It will, therefore, be interesting to study another such example of parallel division:

621.882.3 $\cong$ 621.882.21

With the help of this instruction for parallel division, compound numbers for specific subjects can be formulated, e.g.

621.882.31	Hexagon-head nuts
from 621.882.3	Nuts
and 621.882.211	Hexagon-head screws, and nuts.

It is clear that the digit 1, which occurs after 621.882.21, has been added to the base number 621.882.31 to denote the compound number. A word of caution may be given here. After formulating such a class number, the classifier will pause for a moment and scan the schedule to ensure that the resultant number does not occur therein.

A remarkable feature of the UDC schedule (1985) is its numerous devices for parallel divisions whereby the addition of a single digit becomes adequate for the formulation of compound numbers for specific subjects.

For example, the application of the parallel divisions 623.459.61/.68 $\cong$ 614.891/.898 can be used to formulate the numbers as shown below:

623.459.68	Protection of the skin aga inst mustard gas
from 623.459.6	Individual protection against war gases
and 614.898	Protection of the skin



It is apparent that the single digit 8 has been lifted from 614.898 and added to the base number 623.459.6 resulting in the formation of compound number for the target subject.

An instruction for use of .0 special auxiliaries occurs at 624.01/.07 with the stipulation that .01,.04 and .07 (which relate to all structures generally) may be used mainly under 624, while .02, .03 and .05 (which relate primarily to buildings) are applicable mainly to 69; it will be worthwhile to examine the implications of the instruction through appropriate examples as are given below:

624.014.7.078.44	Rivetted joints for light metal structures
from 624.014.7	Light metal structures.
and 624.078.44	Riveted joints.

An example is given below showing the formulation of a compound number wherein both parallel division and special auxiliary sub-division have been used. The instruction at 629.422.1 states as follows:

629.422.1=629.421

(further details by —1/—9 from 62)

Following this instruction, the compound number, as indicated below, can be formulated:

629.422.16—592.51	Vacuum brakes of mountain-railway steam locomotives.
from 629.422.1	Various kinds of steam locomotives
and 629.421.6	Mountain-railway locomotives..
and 62—592.51	Vacuum brakes.

It is obvious that the digit 6 from 629.421.6, followed by the special auxiliary-592.51 from 62-592.51, have been added to the base number 629.422.1.

The instruction at 629.7.054 states "Denote function by subdivision of 629.7.058, replacing the digits 629.7.05 by an apostrophe." The implications of it can be explained through the following example:

629.7.054.843	Range measurement instruments-
from 629.7.054	Instruments

and 629.7.058.43      Range measurement instruments

In this case, the digits 629.7.05 are replaced by an apostrophe; and the remaining ones, i.e. 843 have been added to the base number for instruments with the help of auxiliary using the apostrophe.

### [ 63. Agriculture and related services

At 630, an instruction appears that the subdivisions of this number have been borrowed from a recognised non-UDC source, i.e., Commonwealth Agricultural Bureaux, U.K. This implies that the asterisk has to be used both in main UDC numbers and in auxiliaries to introduce the notation displayed at 630, e.g.

634.441* 245	Tending of mango trees
from 634.441	Mango
and *245	Tending of trees

Numbers denoting combinations of machines and implements can be built up by borrowing end digits and adding them to 631.3.06 as is being explained through the following example:

631.355.06	Combinations of maize harvesters, pickers, shellers, huskers etc.
from 631.3.06	Combinations of machines and implements.
and 631.355	Maize harvesters, pickers, shellers, huskers etc.

It is evident that the digits 55 have been taken from 631.355 and added to the base number 631.3.06.

An interesting feature of the UDC schedule (1985) is that for ensuring brevity of the tables, numbers are sometimes not displayed but have to be built up with the help of other classes. For example, maize is an oil yielding plant which yields maize oil. But the number for this plant does not exist in the schedule, and has to be built up with the help of parallel division 633.85=665.3. The following example will outline the procedure:

633.853.34	Maize
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from 633.85	Oil-yielding plants
and 665.333.4	Maize oil.

Parallel divisions, which occur at 637 and thereafter, are somewhat different from those which occur at 63, because special auxiliaries of the apostrophe series and parallel division have been used here for the synthesis of compound numbers.

The example of one such parallel division  $637'6 \approx 636$  may be taken for explaining the formulation of the following number for the cited subject :

637.61.'74	Crocodile skin
from 637.61'7	Produce of game and hunted animals.
and 639.14	Crocodile

The digit 4 has simply been taken out of 639.14 and added to 637.61'7 resulting in the formulation of the required number.

#### 64. Housekeeping; Home Economics; Domestic Science

This part of the UDC schedule (1985) is small, and yet self-contained with instructions for parallel divisions for building up compound numbers. One such example may be cited:

64.05  $\approx$  - .05 (Table 1(k))

Following this instruction, a compound number, as shown below, can be formulated :

64.058.243.2	Dwelling arrangements for industrial workers.
from 64.05	Dwelling arrangements
and -058.243.2	Industrial workers

Following this methodology, compound numbers of similar nature can as well be formed, e.g.

64.05-058.65-056.26	Dwellings for war-disabled persons.
from 64.05	Dwelling arrangements etc.
and -058.65-056.26	War-disabled.

The following subdivision may now be considered:

641.568	National dishes, specialities etc.
	Details by (4/9).

On the basis of this instruction for the application of the space auxiliary, the following number can be formulated :

641.568 (510)	Chinese dishes.
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## 65. Management and Organisation of Industry, Trade and Communication.

As the caption indicates, this subclass is concerned with the management aspect of commerce and industries, and also communication. A few of its parallel divisions may be taken up for discussion to show how it helps to formulate compound numbers for specific subjects. For example, with the help of the parallel division  $651.71.2 \approx 535'2$ , the following compound number can be formed:

651.71'236.6	Olive coloured printed forms
from 651.71	Printed forms
and 535—236.6	Olive colour.

Another parallel division  $656.073.852/.856 \approx 656.085.2/.6$  may be cited to show how the following compound number can be formed with its help:

656.073.855	Damage caused by fires
from 656.073	Damages caused by natural calamities
and 656.085.5	Fires. Conflagrations

Even in the absence of instructions, digits can be taken out of one number and added to another for building up compound numbers provided the base number remains the same in both cases, e.g.:

656.121.022.5	Time table for urban public conveyances.
from 656.121	Public conveyances in towns.
and 656.022.5	Time tables

Another example of similar type is given below:

658.562.6.011.7	Errors in control and inspection of products.
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from 658.562.6	Control and inspection of products.
and 65.011.7	Errors.

In the classes belonging to 65, common subdivisions from the table 1(k) have been frequently used to denote the "persons and personal characteristics" of the subject, for example, the auxiliary-051 can be added to the base number where persons are targets, e.g.

659.125—051	Commercial artists
from 659.125	Use of graphic art, photography etc.
and —051	Persons as agents, doers, etc.

## 66. Chemical Technology; Chemical and Related Industries

The users will find that many chemical elements and compounds are common both to 54 and 66. The subclass 54 is concerned with the study and theoretical aspects of these materials, while 66 deal with their industrial aspects including manufacture, production etc.

At 66.047.4, the number 66.047.1/.3 is the source for the parallel division of one of its subdivisions, i.e. 66.047.41/.43  $\approx$  66.047.1/.3. On the basis of this instruction, a compound number can be formulated for a document on 'batch drying at high temperature':

66.047.43	Batch drying at high temperature
from 66.047.4	Batch drying
and 66.047.3	Drying at high temperature

In the beginning of this exposition, the principle of 'final digits' auxiliaries with three points...1/...9 has been explained. This principle can be applied to this class for building up of compound class number. For example, the instruction for the parallel division 661.8...27  $\approx$  546 appears at 661.8. The implications of it may be explained through a few examples as cited below:

661.832.3	Potassium cyanide
from 661.832	Potassium compounds in general
and ...3	Cyanide

It may be noted that the final digits merge with the rest of the class number which have no facet indicator. The transition from the 'metal' facet to the 'oxide' facet is not marked in some cases which means that repunctuation will be necessary, e.g.

	661.847.932.1	Zinc chloride
from	661.847.9	Zinc compounds
and	...321	Chloride

At 661.8...34, instructions exist for the parallel division where the source number itself provides the source for parallel division of one of its subdivisions.

On the basis of these instructions for the parallel division  $661.8...34 \cong 661.8...32$ , the following compound number for the cited subject can be formulated, e.g.

	661.846.34	Magnesium bromide
from	661.846	Magnesium compounds
and	...34	Bromine compounds.

Similarly, the implications of the parallel division  $661.8...35 \cong 661.8...32$  can be made explicit through the following example :

	661.832.35	Potassium iodide
from	661.832	Potassium compounds
and	...35	Iodine compounds

Again, the parallel division  $661.8...36 \cong 661.8...32$  may also be used to formulate number for the chemical compound sodium fluoride, e.g.

	661.833.36	Sodium fluoride
from	661.833	Sodium compounds
and	...36	Fluoride compounds

An instruction appears at 661.8...9 for the formulation of class numbers denoting complex and double compounds, and salts with the help of the following parallel division :

661.8...9  $\cong$  546

Here, the terms complex and double compounds mean compound salts and complex salts. If the classifier is not familiar with these chemical terms, he may have to consult some technical dictionaries on the subject. To save his time,

such technical terms have been briefly explained in this book wherever necessary.

Before proceeding further, the meaning of these terms need to be explained. At the beginning, the definition of 'salt' is given.

A salt is a compound formed by the partial or complete replacement of the replaceable hydrogen atom or atoms present in the molecule of an acid by a metal or a group of elements acting like a metal, e.g. magnesium chloride.

661.846.321	Magnesium chloride
from 661.846	Magnesium
and 661.8...32	Chloride

As regards double and complex salts, many inorganic compounds exist which are formed by the combination of two or more molecules in which the normal valencies of their constituent atoms are apparently satisfied. Potash alum,  $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$  is an example of double salt.

According to their behaviour in the state of solution, two distinct types of such compounds may be distinguished, i.e., double salts and complex salts.

The characteristic feature of double salt is their complete dissociation and loss of individuality in solution retaining their distinct entity only in the solid crystalline state. A double salt may be regarded as a single salt possessing characteristic crystalline structures only in the solid state; but in solution, it is resolved into and gives the reactions of salts they are obtained from. A solution of potash alum in water is in every way identical with a solution of equimolecular quantities of potassium sulphate and aluminium sulphate as it gives tests for  $K^+$ ,  $Al^{+++}$  and  $SO_4^{*-}$  ions. A double salt may be regarded as a single salt possessing characteristic crystalline structures only in the solid state. When in solution it is resolved into and gives the reactions of salts they are obtained from. An example showing the method of formulation of class number for a complex salt is given below :

661.862'325.3	Potassium aluminium sulphate
	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

from 661.862	Aluminium compounds
and 661.832	Potassium
and 661.8...53	Sulphate

Complex salts retain their separate entity both in the solid state or in solution. Potassium ferrocyanide, for example, has to be formulated as  $K_4Fe(CN)_6$ . When ionised in solution, the complex ion, e.g. ferrocyanide ion,  $Fe(CN)_6^{4-}$  is stable both in solid state and in solution. Some examples of complex salts are potassium argentocyanide, potassium cobaltinitrite, and those which form salts of many metals like Cu, Ni, Co etc., with ammonia, e.g., Cuproammonium sulphate,  $[Cu(NH_3)_4]SO_4$ . These salts give complex ions when dissolved in a solvent. The structure and formation of these complex compounds have been explained by the electronic theory of valency.

For the present, an example showing the formulation of class number for a complex compound is given which also indicates the methodology of application of final digits in such cases :

661.8327'34.2	Potassium cobaltinitrite $K_3[Co(NO_2)_6]$
from 661.832	Potassium compounds
and 661.873	Cobalt compounds
and 661.8...42	Nitrite

Now, a number with its base at 662 may be considered. On the basis of instruction for the parallel division 662.2-31/-38  $\cong$  662.231/.238, the following compound may be formulated :

662.231.21--351	Mixture of nitrocellulose and picric acid.
from 662.231.21	Nitrocellulose
and 662.235.1	Picric acid

It may be noted that the digits 351 have been taken out of the number 662.235.1 and added to the base number 662.231.21. The presence of -31/-38 in the target number makes it necessary that the digits have to be preceded by a hyphen.



At 669 metallurgy, final digits have been used for denoting a limited range of alloys by their addition to the main number 669.2/.8, with the replacement of digits 669 by an apostrophe, e.g.

669.35	Copper alloys
from 669.3	Copper
and 669...5	Alloys

A similar example may also be given :

669.35'6	Alloys of copper with tin (bronze)
from 669.35	Copper alloys
and 669...6	Tin

It may be noted that the alloys are classed at the number for the main constituent, followed by the suffix 5 which has been derived from...5; similarly...6 has been used for denoting the fabrication and finishing of specific metals and/or alloys, e.g.

669.218.7	Electrolytic deposits of gold on other metals or their alloys.
from 669.21	Gold
and 669...87	Electrolytic deposits of the metal.

An example of the application of the final digits for the formulation of compound numbers on the basis of parallel division (669.056.9 $\approx$ 669...69) may be cited:

669.056.9.691	Anodized surface finished metal
from 669.056.9	Surface-finished metals
and 661...691	Anodized finish

In the absence of instructions for the formulation of a compound number for a specific topic, the user has to scan the enumerated table, select appropriate class numbers, take out digits from one and add them to the base number to arrive at the target number, e.g.

669.177.013.5	Pure iron electrolytic production plant
from 669.177	Electrolytic production of pure iron.
and 669.013.5	Metallurgical plants and works.

The notable feature of the class metallurgy is that the special auxiliaries of the apostrophe series can be used to synthesize compound numbers for metallurgical alloys, e.g.

	669.18'26'27	Chromium—tungsten steel (high-speed tool steel).
from	669.18	Steel
and	669.26	Chromium
and	669.27	Tungsten

The discussion on numbers based on 669 may be concluded with the citation of the following example:

	669.18'26	Stainless steel
from	669.18	Steel
and	669.26	Chromium

It may be relevant to mention that chromium, in small amounts, hardens steel and increases resistance to shock, while, in a larger amount, it improves the resistance of steel to corrosion. Hence, the alloy is known as the stainless steel.

#### 67. Various Industries ; Trades and Crafts

The subclass 67 is mostly enumerated with occasional instructions for parallel divisions thrown in-between displayed numbers. Thus this table is easy to use. Even then, some examples need to be given to indicate how the -1/-8 special auxiliaries listed under 62, and the -9 auxiliaries listed under 66 can be applied to this class, e.g.

	674.6-419	Wooden packaging from plywood (plywood packaging)
from	674.6	Wooden packaging
and	62-419	Plywood

Following the parallel division 677-9 $\approx$ 66-9, the following compound number can be formulated:

	677-912	Fluidised process plant operation
from	677-9	Process and plant operating characteristics
and	66-912	Fluidised state process

Another example of parallel division is shown as follows:

678.032.12/.19 $\approx$ 678.021.2/.9

The following compound number can be formulated on the basis of this parallel division:

678.032.17	Coagulation of untreated rubber by drying
from 678.032.1	Untreated rubber
and 678.021.7	Coagulation by drying

It may be noted here that the addition of a single digit 7 is sufficient to formulate this compound number for a specific subject.

#### 68. Industries, Crafts and Trades for Finished or Assembled Articles

The subclass 68 is an extensive one wherein provision has been made for parallel divisions, final digits and special auxiliaries (including those belonging to apostrophe series). These devices are helpful in formulating class numbers for specific topics because, besides ensuring the brevity of numbers, they help to make the numbers co-extensive to the subject classified. Special features of this subclass will be exhibited through some selected examples. For the present, an example based on '681.3 Data processing equipment' is shown below:

681.3.048.5	Coded, error-correcting alphanumeric system
from 681.3.048	Alphanumeric systems
and 681.3.04...5	Coded, error-correcting

The final digits have been used here for formulating the compound number.

Another example, based on 681.3, which shows the formulation of compound number through two distinct stages as indicated below:

681.322.107.66	Automatic digital computer with manual data input and magnetic core storage.
from 681.322.1	Automatic digital computer with manual data input.
and 681.307.66	Magnetic core storage

Now, it will be interesting to know how the number 681.307.66 has been formulated with the help of parallel division  $681.3.37 \cong 681.327$ . The process is shown below:

681.307.66	Magnetic core storage aspects
from 681.3.07	Storage aspects
and 681.327.66	Magnetic core storage

It is evident that the digits 66 have been taken out of 681.327.66 and added to 681.3.07 to arrive at the number 681.307.66; thereafter, the digits 0766 are taken out of the number 681.307.66 and added to 681.322.1 for constituting the number 681.322.107.66 which is co-extensive with the subject.

An instruction occurs at 681.327.1 which needs interpretation. It states that "Class writing and reading devices for specific media and equipment under 681.327.3/.8, denoting concepts listed here by "1 sub-divided as 681.327.1".

It means that any of the enumerated numbers starting from 681.327.3 to 681.377.8 can be used as a base number for subjects relating to '681.3 Data processing equipment'. Thereafter, the numbers ranging from 681.327.11 to 681.327.18 have to be considered. The digits which occur after 681.327.1 have to be taken out and added to the base number with the help of auxiliary with apostrophe for arriving at the required number e.g.

681.327.44'17	Checking and verifying devices for punched tape equipment.
from 681.327.44	Punched or embossed (chordless) tape equipment.
and 681.327.17	Checking and verifying devices.

An example is given below showing the method of formulation of a compound with the help of parallel division  $681.7.067.26 \cong 681.7.067.25$ , and then by selecting the end digits from compatible numbers of the table, and then adding them to the target number:

681.7.067.265.2	Optical projection by telephoto lens.
from 681.7.067.26	Optical projection objectives
and 681.7.067.252	Telephoto lens

An instruction occurs at 681.85 stipulating that materials may be denoted by -03 from table 1(k). This idea can be brought to focus through the following example:

681.85 -036.544	Production of cellulose acetate plastic records.
from 681.85	Production of records
and -036.544	Cellulose acetate plastic

The number for the 'cellulose acetate plastic' has, in turn, been derived through the parallel division  $-036.5 \approx 678.5$ , e.g.

-036.544	Cellulose acetate plastic
from -0.36.5	Plastics in general
and 678.544	Plastics based on cellulose acetate.

The parallel division  $684.4.03 \approx 7.03$  makes it possible to combine the aesthetic aspect with such industrial products as 'furniture'. Numbers for imitation furniture of the bygone ages can be formulated with its help. One such example is given below:

684.4.033.54	Reproduction period of later gothic furniture
from 684.4.03	Reproduction furniture
and 7.033.54	Later gothic (transitional to Renaissance)

This number has, in turn, been formed from  $7.033.5...4$  with the help of final digits.

Again, the following example will show the process for the formulation of a compound number with the help of the parallel division  $688.727.1 \approx 629.11$ , e.g.

688.727.186-86	Spring-powered toy motorcycle
from 688.727.1	Toy land vehicles
and 688.11.6	Motor cycles

Thereafter, -86 has been taken out of 62-86 and added to the base number 688.727.186.

#### 69. Building (construction) trade, Building materials; Building practice and procedure

This subclass has some features in common with those of

624 and 628 as will be apparent from the fact that a number of parallel divisions and 'see also' references (marked by arrow) are dispersed throughout the table. These devices have made it possible to keep the table brief and, in turn, underlines the flexibility of the UDC scheme (1985).

An example is given showing the formulation of a compound number in two successive stages with the help of parallel divisions. At first, the number formed with the help of parallel division  $697.52 \approx 697.51$  is given below:

697.521.29	Solar-heated boiler plant and equipment for vacuum steam-heating systems.
from 697.52	Vacuum steam-heating systems.
and 697.512.9	Solar-heated boiler plant and equipment.

Now, the method whereby the subsequent number 697.512 has been formulated with the help of parallel division  $697.512 \approx 697.32$  is shown below:

697.512.9	Solar heated boiler plant and equipment.
from 697.512	Boiler plant and equipment
and 697.329	Solar heating devices

It is evident that the end digits from respective source numbers have been successively added to the base number resulting in the formation of the number for the cited subject.

### The Arts; Recreation; Entertainment; Sport (7)

In comparison with other classes, the class 7 extends over a relatively short space in the schedule. Here, the mode of application of final digits needs to be noted.

7.034.4	Early renaissance
from 7.034	Renaissance
and 7.034...4	Early (renaissance)

The three points of 7.034...4 have been omitted, and the final digit added directly to the base number.

Thereafter, if a geographical grouping of styles is needed, then the place auxiliaries from the table 1(c) are added to yield the required numbers, e.g.

7.034(541)

Early renaissance in Eastern India

Another example may be cited where the common auxiliaries of place and time have been intercalated to denote geographical and chronological grouping, e.g.

	7.036(440)1	Realistic trends in French art
from	7.036	Modern art movements
and	7.036.1	Realistic trends
and	(44)	France

Further, an example is given below showing that the digits from 7.01/04 can be added to 75.01/.05 to yield compound numbers based on 75:

	75.041.5	Painting of portraits
from	75.04	Subjects for painting
and	7.041.5	Portraits

The parallel division  $77-1/-5 \cong 62-1/-5$  makes it possible to derive digits from 62 for addition to the base number 77 to denote mechanical aspects of the target subject. The following example may be considered:

	77-523.8	Electronically controlled photographic equipment.
from	77-1/-5	Characteristics of photographic equipment.
and	62-523.8	Electronically controlled machines.

An example is given below showing the formulation of a compound number by the addition of end digits from other numbers:

	77.725.023.415.021.12	Special emulsions for colour developers influencing the colour of image.
from	77.725	Colour developers
and	77.023.415.5	Influencing of image colour
and	77.021.12	Special emulsions.

From the above noted example, it is clear that the digits .023.415.5 and .021.12 have been taken out of two separate numbers and added to the base number 77.725. The decimal

points remain where they were and are not shifted after every third digit, as are done in case of parallel divisions.

At the subdivision 796.42 Athletics in general, an instruction has been given for denoting distances with the help of numbers from the table 1(c) which displays common auxiliaries of place. In the table, the distances are denoted by (181). To make it precise, standard international abbreviations for unit followed by actual figures have to be added to (181), e.g.:

(181 Km 20)	20 Kilometres
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The use of such numbers can be shown through the formulation of the following number:

796.72.093.55	20 Kilometres	cross-country
(181 Km 20)	motorcycle racing	
from 796.72	Motorcycling	
and 796.093.55	Cross-country	
and (181 Km 20)	20 Kilometres	

Following this methodology, class numbers can be formulated for many types of sports, athletics etc., showing the distance and also the duration.

### 8. Language. Linguistics. Literature

The class 8 has been divided mainly into the following sub-classes

80 Linguistics. Philology. Languages
82 Languages in general.

The subclass 80 has, in turn, been divided into nine subdivisions, i.e. 801/809.

The table 1(c)—common auxiliaries of language form the basis for the parallel division of 802/809 'Individual languages' and 820/899 'Literatures of individual languages' by substituting the digits 80 or 8 respectively for the equals=sign, e.g.

805.0	Italian language
from 80	Languages
and =50	Romanic languages (Italian).

The language auxiliaries can be derived by making the reverse substitution, i.e., by substituting the equals=sign for 80, e.g.

.805.0	Italian languages
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If the digits 80 are replaced by = sign, then the number assumes the following shape

=50 Italian language

Thus, by following the guideline for parallel division (802/809)-0  $\cong$  800, the following number can be formulated:

805-0855 Colloquial Italian language  
from 805.0 Italian language  
and 800.855 Colloquial language

Again, on the basis of instructions for the parallel division 802/809-1/-8  $\cong$  801.1/.8, the following compound number can be formulated:

809.143.3-677 Urdu verse forms  
from 809.143.3 Urdu  
and 801.677 Verse forms

Similarly, another number based on this guideline is given below:

809.12-561.2 Sanskrit intonation  
from 809.12 Sanskrit  
and 801.561.2 Intonation

The literature in individual languages can be denoted by a number from 820/899, and names of individual authors specified by common auxiliary subdivisions belonging to the table 1(h), e.g.:

891.2-13 Epic Sanskrit poems  
from 820/899 Literature of individual languages  
and 891.2 Sanskrit literature (formed by the addition of =912 to 820/899)  
and 82-13 Epic poems.

As already stated, literatures of individual languages are denoted by 820/899 wherein an instruction appears for the parallel division 820/899  $\cong$  802.0/809.9. On the basis of this guideline, the following compound number can be formulated:

894.811 Tamil literature  
from 820/899 Literatures of individual languages  
and 809.481.1 Tamil language.

Similarly, the number for Hindi literature will be 891.432, where 809.143.2 is the number for Hindi language.

Thus, the class 8 combines in itself the guidelines and features for literature and languages. Hence, the class 4 could be kept vacant for future needs.

### 9. Geography; Biography; History

The class 9 covers over only a few pages; but due to the provision of numerous parallel divisions, a wide range of topics can be covered. For example, on the basis of the parallel division  $912.4 \approx 084$ , table 1(c), the following number can be formed:

912.43—223	Airphoto mosaic images
from 912.43	Cartographic images, maps etc.
and (084.3—223)	Airphoto mosaic

The number 912.43 has, in turn, been derived with the help of the parallel division  $912.4 \approx (084)$  as shown below:

912.43	Cartographic images, maps etc.
from 912	Non-textual representation of a region as expression of geographical knowledge
and (084.3)	Cartographic images

The parallel division  $913.2/.9 \approx (32/39)$ , table 1(e) can be used for formulating numbers for the geography of other individual countries of the ancient world:

913.997	Geography of pre-Columbian America
from 913.2/.9	Geography of other individual countries of the ancient world.
and (399.7)	Pre-Columbian America

Individual countries and regions of the modern world can be denoted by numbers formulated on the basis of the parallel division  $914/919 \approx (4/9)$ , table 1(e). The following example may be seen:

915.455	Delhi (as geographical entity)
from 914/919	Descriptions of individual regions and countries of the modern world
and (545.5)	Delhi

Bibliographical and related studies have been relegated to 929. Thereafter, the user is confronted with 93/99 History. The parallel division 931.5/939.97 $\equiv$ (315/399.7), table 1(e) is helpful for the formulation of numbers denoting the history of ancient world, e.g.

935.4	History of Babylonia
from 931	Ancient history in general.
	History of ancient peoples
and (354)	Babylonia

Another example may be cited:

939.97	History of Pre-Columbian America.
from 931	American history in general
and (399.7)	Pre-Columbian America.

Thereafter, the subclass 941/99 is divided primarily according to place where direct divisions are derived from table 1(e) common auxiliaries of place (41/99). An example is given below:

942 (420)	History of England
from 942	History of England and Great Britain.
and (420)	England

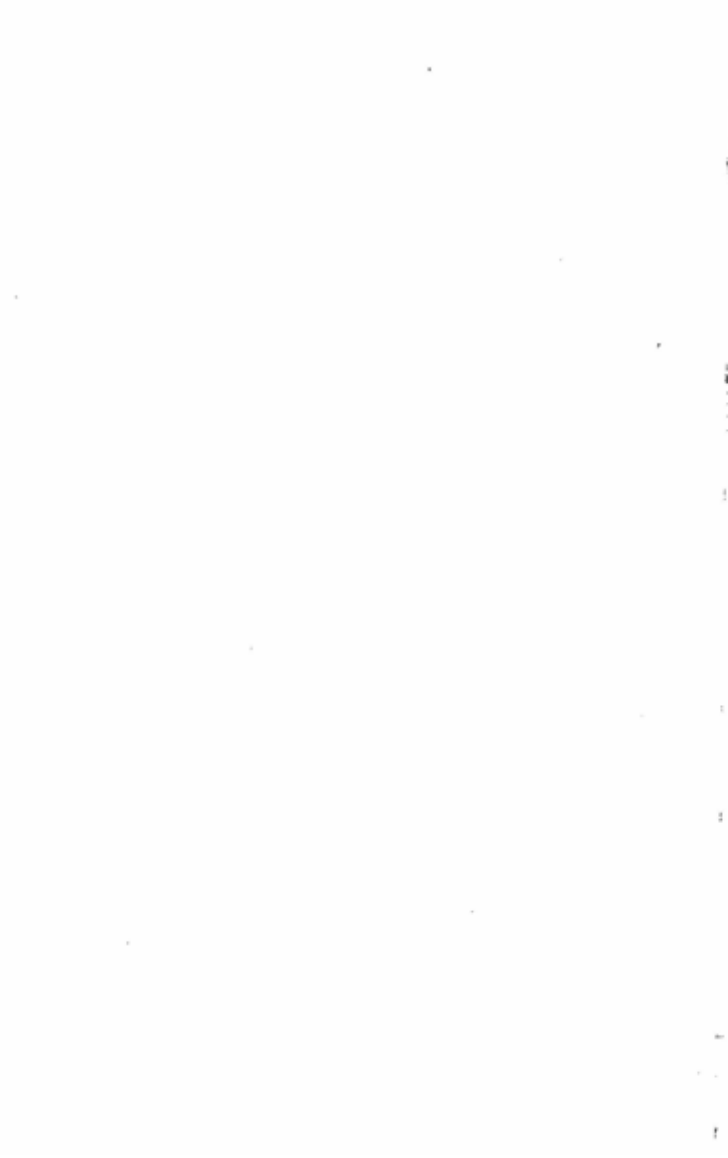
Alternatively, the number 942 (420) can be expressed as 942.0, but it is more convenient to omit the zero, and write the number as 942.

The ensuing pages deal with the methodology of practical classification which may be studied against the backdrop of what has been discussed in this chapter.

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## **PRACTICE**

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## **Methodology of Classification**

### **The Quest**

In the previous chapter, examples have been given under respective classes showing the application of diverse techniques in formulating class numbers. But, techniques are different from methodology; the former can be considered as the tools, while the latter as the framework of practical classification. Cases are not infrequent when two persons classifying the same document formulate differently structured numbers even when no 'bias' is involved. Such anomaly occurs not because of classifiers having the autonomy of decision and the scheme being flexible enough to permit variations of approach. It is caused by not following a consistent methodology which determines the structure of the class number. This methodology is important because it constitutes the foundation on which the framework of classification rests. Even more important is the theoretical base of classification on which the methodology rests. Keeping this in view, the theoretical aspects of classification has been laid down in the beginning of chapter 1. Before venturing into the realm of practical classification, it may be worthwhile to briefly recapitulate what has already been discussed before.

As is known to all, the theoretical base for book classification had largely been established by Sayers and Ranganathan. The methodology of practical classification is largely dependent on the facets into which the subject of a document is analysed. The meaning of 'facet' needs to be made explicit. It may be recalled that the totality of divisions of a basic class according to a single train of characteristics is said to constitute one of its facets. The concept of facet may not be comprehensible to those who are not familiar with the theory of classification.

To them, the facet will appear as synonymous with the 'element' or 'aspect' of a subject. They are advised to consider the basic class as a cut gem; a cut gem has many faces each of which can be called as its facets. Similarly, the subject of a document has many faces; these faces may be considered as facets of the basic class of a subject.

The problem of practical classification can be viewed as the process of analysis and synthesis of concepts underlying the subjects. So, the process of analysing subjects into their facets (or categories) and the subsequent operation of combining terms from different facets to constitute a subject, compound or complex, will now be described. As this discussion proceeds, it will be noticed that when these facets are represented by numbers and then combined, the number for the subject as a whole is obtained. The purpose behind this exercise will now be indicated.

It has been noted that for practical classification, the subject of a document having more than one aspect (or elements) is considered as being made up of facets. For further explicitness, a subject with more than one aspect (or facet) may be considered. In such case, when these different aspects, so selected as to represent multiple facets of a subject, are represented by numbers, and these, in turn, integrated to form the class number of the subject, the facets are said to have been cited. In other words, each facet symbolises a particular aspect of the subject. Thereafter, these aspects (or facets) can be aligned in a certain prescribed sequence. This prescribed sequence (or order) of alignment of facets is known as the citation order; it is also known as the facet formula.

Now, the question arises as to what that particular 'prescribed order' which determines the ordering or mode of citation of facets is. At this stage, it may be stated that this 'order' is the sequential alignment of facets from the 'most concrete' to the 'least concrete'. For, example, the following subject may be considered:

Lubrication of internal combustion engines

This is a compound subject. It is evident that the term 'internal combustion engine' constitutes the primary aspect

of the subject, while the other term 'lubrication' which is dependent on it is the secondary aspect of the subject. In pursuance of the prescribed order, the facets get aligned in graduated sequence from the 'most concrete' to the 'least concrete' aspect, e.g.:

International combustion engines: Lubrication

This particular 'prescribed order', based on the idea of decreasing concreteness is known as the standard facet formula.

Caution has to be exercised in deciding the citation order where 'bias' is involved. This means that the nature of collection, which decides the 'bias', forms the context against which the order of citation has to be considered. For example, if the aforesaid document belongs to a collection on 'lubrication' for different types of engines and machines, then this aspect forms the primary facet and the citation order has to be reversed as follows:

Lubrication: Internal combustion engines

As regards the practical classification, various propositions have been made to lay down the methodology. A few of them can be described.

### **The Principles**

First of all, one may like to have a close look at the proposition contained in the BS 1000 C (1963). This British standard attempts to provide a theoretical base for the UDC classification. In doing so, it lays down a number of principles for deciding upon an acceptable citation order of facets. These principles, which are somewhat hypothetical, can be outlined as follows:

- (i) *Subject factors will have precedence over others, e.g.*

547 (031)

Organic chemistry: encyclopaedia

Here, the subject factor 'organic chemistry' is cited first, followed by the 'encyclopaedia', which, being merely the form of presentation, is the secondary aspect of the subject.

But, if it is desired to have all these forms (e.g. encyclopaedia at one place in the interest of users, then the document will have the following class number;



03 : 547

Encyclopaedias: organic chemistry

(ii) *Traditional way of looking at subjects, e.g.*

820—1 English poetry

As the users expect to find 'poetry' under literature which is the traditional way of looking at subjects, the number 820-1 will be appropriate.

The other alternative is to classify the subject under linguistics by allotting the number 802 : 82-1 which represents English poetry from a linguistic viewpoint. The number is not suitable because poetry is related more to literature than linguistics.

(iii) *Most concrete to least concrete*

This principle of citing more concrete facets before less concrete ones had been formulated by Ranganathan in Colon classification and is expressed through his facet formula PMEST, i.e. Personality—Matter—Energy—Space—Time.

But, the conceptual preciseness of the term 'concrete' is elusive due to the following reasons. According to this principle of decreasing concreteness, the facet 'time' is the least concrete in the facet formula, PMEST. But the 'time' is an important factor in all the fine arts, i.e., paintings, architecture etc. It may, therefore, find precedence over other facets which are more concrete than the 'time' facet.

The citation order of the UDC scheme is flexible enough to accommodate such eventualities, as will be evident from the following example:

Twentieth century jazz music in the U.S.A.

This subject can be represented by any of the following numbers:

"19" 785. 16 (73)

785 "19" 16 (73)

785. 16 "19" (73)

In the UDC scheme, the time auxiliary is usually cited after the main number. But, as the quotations are biterminal, they permit reversal of the order of intercalation.

(iv) *Means to be subordinated to ends*

The principle of subordinating means to ends is based on the fact that to get an end-product, some kind of operation is necessary, e.g.

671.2.02	Fancy jewellery: Manufacturing process
from 671.2	Fancy jewellery
and 67.02	Manufacturing process

In this number, the operation 'manufacturing process' has been subordinated to the end-product 'fancy jewellery'.

(v) *Subordination or dependence one facet to the other*

This principle which is a corollary of (iv), can be explained as follows: when 'part' is dependent on 'kind', and 'kind' is, in turn, dependent on 'whole', then the citation order will be 'whole-kind-part' and not the other way around, e.g.

629.735.33.035.5      Propellers of landplanes

The subject can be analysed in terms of standard facet formula as follows:

Aircraft—Landplanes—propellers

The citation order, if based on the aforesaid principles, is supposed to reflect users' interests, consistency of approach, and ensure a helpful order of elements within a class number. Based on this hypothesis, the following standard facet formula for the citation of elements has been propounded in the BS 1000C (1963):

Whole thing—Kinds—Parts—Materials—Properties—  
Processes—Operations—Agents.

All these elements are unlikely to get reflected at a time in the subject matter of a single or all documents. But, the chances do exist that some of these elements will occur in nearly all documents. So, it is surmised that if classifiers follow this standard facet formula, they will arrive at correct conclusions regarding the citation order of facets and be able to formulate numbers consistent with the subject of documents.

This standard facet formula contains such terms denoting multiple aspects of a subject which may appear as overlapping to many. Nevertheless, the array of these aspects in the standard facet formula stresses the basic principle of alignment

whereby the 'most concrete' is followed by the 'least concrete'. This idea is an offshoot of Ranganathan's chain indexing which will be discussed in the appropriate context.

### Steps to classification

Ranganathan had proposed for the adoption of nine successive steps for the classification of documents. These steps can be briefly stated as follows:

*Step 0* Raw title which is, in fact, the name of the subject as is found in the title page of a document; *Step 1* Expressive title (to be derived from the Raw title); *Step 2* Title in Kernel terms (to be derived from the Expressive title); *Step 3* Analysed title (to be derived from the Kernel title); *Step 4* Transformed title (to be derived from the Analysed title); *Step 5* Title in Standard terms (to be derived from the Analysed title); *Step 6* Title in Facet terms (to be derived from the title in Standard terms); *Step 7* Class number (to be derived from the title in Facet terms); *Step 8* Verification (the synthesised class number has to be translated, analysed, interpreted and verified).

Those who are interested in the original discourse of Ranganathan on this subject, may read it in the chapter SB of his book entitled "Prologomena to Library Classification Ed. 3." This proposition, though developed in the context of colon classification, may serve as the base for other classification schemes as well. But this process, being expensive and elaborate, will not save the time of classifiers who would prefer to follow a less devious path.

### Conciliatory Approach

The methodology of classification which is different from the aforesaid process needs no further elucidation here as it will be explained and followed hereafter.

After going through the propositions discussed so far, one is constrained to believe that a methodology is needed which should ensure a service that is faster and yet accurate enough for practical classification. The base for providing a methodology to that end rests with the principle of chain indexing in reverse which will preferentially serve as guidelines to practical classification.

A class number is built up of elements starting from the 'most concrete' to 'least concrete' aspect. In contrast to it, the primary index entry with full-length chain based on it, has the sequence of elements aligned from the 'least concrete' to 'most concrete' aspect. If this order is reversed, then the elements will get aligned in the same order as that of those in the class number. This alignment of elements in the order of decreasing concreteness may be termed as the chain index in reverse. It, therefore, becomes logical that such an alignment of elements, which follows the 'most concrete' to 'least concrete' sequence be chosen for practical classification. Thus, the reversed order of elements in a primary index entry with full-length chain is the base on which class numbers should be built. For example, the following subject may be considered:

Maintenance of diesel engines.

If the subject is chain indexed, then the primary index entry with full-length chain will assume the following form:

Maintenance: Internal combustion  
engines (diesel type): Mechanical  
engineering: Engineering.

When the chain is reversed, the following form emerges:

Engineering: Mechanical engineering:  
Internal combustion engine (diesel type):  
Maintenance.

After these elements are substituted by respective class numbers, the following sequence is derived:

62:621: 621:4:621.43: 621.436.1:62-7

In an evolutionary process, the lower species get extinct and complex ones survive. The analogy, though rather far-fetched, can be cited when one sees how classes, subclasses and subdivisions gradually fade away evolving into a number, which may be simple, compound or complex.

Thus, in the following example, these individual numbers ultimately merge into 621.436.1 which, when joined with 62-7 by colon becomes a complex number, i.e.

621.436.1:62-7 Maintenance of diesel engines.

The facet indicator can be eliminated, and integrated class number expressed as follows:

621.436.1-7

Maintenance of diesel engines.

The entire exercise of analysis has to be conducted mental on a plane. However, for the convenience of users, the steps will be traced in the examples that will follow. While doing actual classification work, these intermediate steps need not be written down. With a little practice on these lines, the classifier will be able to comprehend all the steps and arrive at the appropriate number.

The following subject may be considered:

### **Trials for Mass Production in Industries**

The subject is compound because it reflects more than one facet within a conventional class. At first, the classifier will have to use his perceptivity to understand that the subject pertains to management and organisational aspects of industries, and not actual production; he has to discern the degree of decreasing concreteness of its constituent facets. There is no shortcut to it. Now the subject may be analysed into its constituent elements which, in turn, be aligned according to standard facet formula:

Industry: Organisation: Mass Production: Trial

When translated into UDC numbers, the class numbers will assume the following form:

65: 658.526: 65.012.14

Integrating the sequence of numbers, the class number for the subject assumes the following form:

658.526.012.14      Trials for mass production in industries.

Again, the following subject may be considered:

Missile systems for aerial warfare.

The subject is complex because it reflects more than one distinct conventional class.

Depending upon the nature of collection to which the document belongs (i.e. bias), it may either be related to 'military affairs' or 'military engineering'.

There exists a distinction between 'military affairs' and 'military engineering'. The concept 'aerial warfare' belongs to the former category, while the 'military engineering'

pertains to the latter. So, if the document bearing the subject belongs to a collection on 'military affairs', then the arrangement of its elements will be in the following order:

Aerial warfare: Missile systems

These aspects can be represented by numbers as follows:

355.46: 623.419 Aerial warfare: Missile systems.

Alternatively, if the document pertains to a collection on 'military engineering', then elements are cited in a reversed form, e.g.:

Missile systems: Aerial warfare.

It will then have the following class number:

623.419: 355.46 Missile systems: Aerial warfare.

This example indicates that the class number for complex subject has been formed by joining two numbers from two different main classes by colon.

It may be noted here that the use of colon is not limited to interrelating more than one topic from distinct conventional classes. Different topics from any main class can be correlated with colon, e.g.

631.816.1: 633.18 Rate of application of fertilizers  
for rice crops.

But the colon is not always necessary for the formulation of complex numbers for subjects. The introduction of the 'Parallel division' in the UDC schedule (1985) make it convenient to formulate complex numbers with the addition of numerals from class numbers belonging to different main classes. For example, the subject 'Condensers for distillation' may be considered for classification. As instructed by the parallel division 542.48  $\approx$  66.048, the digit 2 of the source number 66.048.2 can be added to the target number 542.48 to arrive at the following number:

542.48.2	Condensers for distillation.
from 542.48	Distillation.
and 66.048.2	Condensers.

By now, the users have become familiar with the 'bias' aspect, and so it is not necessary to multiply such examples. For the sake of brevity, the subjects that are now to be cited

will be without any 'bias'. The following compound subject may now be considered:

Generators driven by gas turbines.

The topic 'generators' belong to the category of 'electrical machines' which, in turn, pertains to electrical engineering.

For the classification of this subject, the classifier may consider the following order of alignment of facets:

Whole thing—Operators—Agents.

The subject will be analysed and its elements aligned according to the aforesaid facet formula:

Generators—motive power—gas turbine

When represented by class numbers, the following form emerges:

621.313.12: 62-843.8

After integrating these coloned numbers and eliminating the facet indicator, the following class number is obtained:

621.313.12-843.8      Generators driven by gas turbines.

A document on stainless steel may now be considered. The classifier may have to consult a technical dictionary for knowing that chromium in large amount improves the resistance of steel to corrosion. Hence the alloy is known as stainless steel. The subject may be as follows:

Stainless steel for the manufacture of faucets.

Knowing that the stainless steel belongs to the category of low-carbon ferrous alloys, the subject can be analysed in terms of its elements which, in turn, can be aligned according to standard facet formula as follows:

Low-carbon ferrous alloys: Chromium steel:

Finished articles: Hardware: Faucets.

These elements can be represented by numbers as follows:

669.151-94: 669.26: 68: 683: 683.567

Integrating these numbers, the following class number is obtained.

669.15'26-194: 683.567

Now, a document on computers may be considered:

Servicing of automatic (programme-controlled) calculators.

The subject, which belongs to data processing devices, can be analysed into its constituent elements and arranged according to standard facet formula:

Data processing equipment: Calculating devices: Automatic (programme-controlled) operation: Servicing.

These elements can be represented by numbers as follows:  
681.3: 681.325.5: 681.325...2: 62—7

The classifier, who is now familiar with the concept of 'final digits', can integrate these coloned numbers as follows:

681.325.52—7      Servicing of automatic (programme controlled) calculators.

The classifier will occasionally come across subjects for which no co-extensive class numbers can be formulated. One such example is given below:

Mechanical recognition of spoken words.

The fact that the UDC schedule (1985) has not provided numbers for such specialised subjects which come up as a fallout of the ever advancing frontiers of technology casts no aspersion on the scheme. Any classification scheme, however recent it may be, will never be able to cope with the phenomenal development of science and technology. In such cases, only approximate numbers can be given while the alphabetical index to the classified file takes care of the rest. Details about such index have been given in chapter VI.

So, the above noted subject, which belongs to processes operated by data processing systems, can be analysed, and elements arranged according to standard facet formula:

Design, construction, and layout of data processing systems, machines, elements etc. : sound transmission.

The concept can be remotely represented by the following number:

681.3.02: 534.86      Mechanised recognition of spoken words.

From the cited examples, it will be apparent that depending upon the requirement of the collection, different but appropriate pathways can be adopted to formulate class numbers while taking care to ensure that the basic principles of classification are not infringed or circumvented in the process.

More worked out examples on classification practice are given in the next chapter.



## 5

# Classification Practice

### The Layout

Before embarking on practice, the users may preferably go through the schedule and study the layout of its tables. Contrary to the UDC BS 1000 A (1961) wherein the special auxiliaries are generally cited at the beginning of classes and their subdivisions, these are dispersed throughout the UDC (1985) schedule. It may be noted that the principal divisions are preceded by special auxiliary subdivisions in all the classes. The implications of such a layout of special auxiliary subdivisions will be apparent from some examples which have been derived from numbers enumerated on page no. 281 of the UDC (1985) schedule. This particular page has been selected at random from it. A replica of this page has been given at the end of this 'layout'. In these examples, numbers for certain subjects will be given. These will be followed by exposition explaining the process of formulation of these numbers with the help of special auxiliary sub divisions. These auxiliaries are used for constructing numbers for subjects not enumerated in the schedule. The examples are as follows:

621.922.2.025	Abrasive wheels with carborundum
from 621.922.2	Abrasive tool with carborundum
and 621.922.025	Abrasive wheels
(special auxiliary)	

The number 621.922.2 has, in turn, been formulated with the help of parallel division 621.922.1/.8  $\approx$  621.92.1/.8 as shown below:

621.922.2	Abrasive tool with carborundum
from 621.922	Abrasive tools
and 621.921.2	Carborundum

Here is another example:

621.924.916.023	Rolling-table centrifugals and blast machines
from 621.924.916	Rolling-table blast machines
and 621.924.023	Abrasive particles, sand etc.

This is another example:

621.924.924.37.046	Internal face-grinding machine for centreless grinding.
from 621.924.37	Internal face-grinding machine
and 621.923.046	Centreless grinding
(Special auxiliary)	

The number 621.924.37 has been formulated with the help of parallel division  $621.924.3 \approx 621.924.5$  through a process as shown below:

621.924.3	Internal face-grinding machine
from 621.924.3	Face-grinding machine
and 621.924.57	Internal grinding machine

This is yet another example:

621.927.4.084	Fine crushing plant with rollers
from 621.927.4	Crushing plant with rollers
and 621.927.084	Fine crushing
(special auxiliary)	

It is interesting to note that the special auxiliary subdivision 621.927.084 has been derived from the parallel division  $621.927.082/.086 \approx 621.926.082/.086$  through the following process:

621.927.084	Fine crushing
from 621.927	Crushing
and 621.926.084	Reduction to granular form.

Examples can be multiplied to any extent through a study about the mode of application of special auxiliaries to other classes as well. But, it is assumed that the users have now developed a fair idea about the deployment of these devices, and so any further elaboration is not necessary at this stage.

## SPECIMEN

621.921 ENGINEERING. TECHNOLOGY IN GENERAL 621.927.7

621.921 Abrasives. Grinding materials. Polishing materials

—666.792

- .1 Metallic abrasives. Metal powders, pastes etc.
- .2 Abrasive grits and sands. Emery, sand, glass, basalt. Carborundum and other silicon abrasives and carbides
- .3 Other inorganic abrasives. Polishing rouge (hydrated iron oxide). Tripoli powder (tripolite, diatomite, infusorial earth). Corundum.  
Pumice. Chalk, whiting. Red lead (minium)
- .34 Diamond as abrasive
- .4 Vegetable polishing materials. Cork, wood particles etc.
- .5 Leather, buff, chamois etc.
- .6 Papers and cloths coated with abrasive. Emery paper. Glass-paper. Sandpaper etc.  
—676.265
- .7 Textile fabrics for polishing. Polishing cloths, felts etc.
- .8 Rubbers and plastics for polishing
- .922 Abrasive tools. Grinding and polishing slips, wheels, discs, stones etc.

*For power tools—621.924*

## Special auxiliary sub-divisions

621.922.023 Abrasive sticks, steels etc. Whetstones

.024 Abrasive boards, flat slabs. Grinding slips. Oilstones

.025 Abrasive wheels, discs, drums etc. Buffing discs. Sanding discs. Grinding wheels. Grindstones

## Principal divisions

621.922.1/.8 Abrasive tools according to material

622.922.18  $\approx$  621.921.1/8

.923 Grinding, polish and allied processes (and associated equipment)

## Special auxiliary sub-divisions

621.923.045 Grinding between centres

.046 Centreless grinding

## Principal divisions

621.923.1 Grinding of flat and curved surfaces in general. Surface-grinding, with wheel (as substitute for milling, filing etc.)

.2 Rough grinding. Preliminary trimming, burring etc.

.3 Intermediate, semi-fine grinding. Facing

- .4 Fine grinding. Finishing. Smoothing
- .5 Honing (and hones). Superfinishing
- .6 Edge and tip grinding. Tool grinding, sharpening
- .7 Polishing. Lapping. Buffing. Burnishing (extra-bright, mirror finish). Roll-polishing
- .924 Grinding and polishing machines (for cleaning, sharpening, providing surface key etc.). Bench grinders. Brush cleaning. Sandblasting etc.
  - .2 Grinders with flat or plane surface and linear motion. Reciprocating, oscillating grinders, sanders etc. Continuous grinders, with endless band or belt
  - .3 Face-grinding machines and equipment with rotary disc. Rotary sanders, finishers etc.  
621.924.621.924.5
  - .5 Cylindrical grinding and honing machines
  - .56 External grinding machines etc.
  - .57 Internal grinding machines etc.
  - .6 Special profile grinding machines  
621.924.6.621.833 Gear grinders
  - .7 Cleaning and polishing in revolving drums. Barrel finishers. Tumblers
  - .8 Brush cleaning. Scratch and scaling brushes and brushing machines. Metal brushes etc.
  - .9 Erosion forming, blasting equipment. Sandblasting. Shot-blasting etc. Blast machines and equipment  
—621.547 and references there

#### Special auxiliary sub-divisions

- 621.924.9.023 Abrasive particles. Sand, shot etc.
- 621.924.9.024 Blasting nozzle, jet

#### Principal divisions

- 621.924.91 Blast machines, blowers: main types
  - .911 Open blast machines. Hose or free-jet sandblasters
  - .912 Chest or box blast machines
  - .913 Drum blast machines
  - .914 Rotary table, turntable blast machines
  - .915 Sprocket-table blast machines (suction-type or pressure-type) with revolving or swinging nozzles
  - .916 Rolling-table blast machines
  - .918 Centrifugal blast machines
  - .93 Water-jet blasting (Wet blasting)  
—621.7.024.2

- .95 Enclosures for blasting: housings, casings, cabinets etc.
- .926 Comminution. Crushing. Grinding. Milling. Pulverizing (especially of hard materials)

*Class here comminution in general, as well as comminution of hard materials*

—621.927;662.73;622.923.644.73

#### Special auxiliary subdivisions

- 621.926.082 Preliminary reduction to lumps, chunks. Coarse reduction, breaking, crushing
- .083 Intermediate, secondary reduction. Breaking to smaller pieces. Medium fine crushing
- .084 Reduction to granular form. Fine crushing
- .085 Reduction to particle size. Fine grinding
- .086 Reduction to fine powder. Superfine grinding. Pulverization

#### Principle divisions

- 621.926.1 Breaking and crushing by hand. Breaking with hammers, pounders, pestles and mortars etc.  
—621.927.1
- .2 Mechanical breakers and crushers in general. Jawbreakers. Breakers with shearing anvil
- .3 Crushers and mills with rollers, cones, balls etc. Roller mills. (gyratory breakers, rolling crushers). Ring mills. Centrifugal ball mills. Mortar mills. Pug mills. Edge runners
- .4 Impact crushing mills. Stamp mills. Stamp batteries. Star crushers. Hammer mills. Disintegrators
- .5 Ball mills with screens. Ball drums. Barrel or tube mills. Vibratory ball mills. Aerofall mills. Compound mills
- .7 Mills with shear or rubbing action. Friction mills. Disc, cone and bell mills. Drag mills etc.
- .76 Worm, screw or auger mills  
—621.927.76
- .8 Superfine reduction mills with ancillary separating devices
- .88 Air-swept pulverizers (pulverizers with air current for particle removal). Eddy mills. Vortex mills
- .927 Comminution of soft materials. Crushing. Grinding. Milling. Pulverizing  
—631.333.92;631.361.8;631.363.2;664.7

#### Special auxiliary subdivisions

- 621.927.082/.086 Degree of comminution or size reduction  
621.927.082/.086=621.926.082/.086

**Principal divisions**

- 621.927.1      Crushing and grinding of soft materials by hand  
                    —621.926.1
- .3      Grinding plant and equipment with millstones
- .4      Milling, crushing and grinding plant with rollers
- .7      Small special-purpose mills. Coffee-grinders, pepper mills  
            etc.  
            621.927.7  $\approx$  621.926.7, i.e.  
            621.927.76 Worm or screw mills, e.g.  
                    meat mincers  
            —641.512

**The procedure**

The concepts and principles of the UDC scheme that have been discussed so far need to be put into actual practice. Therefore, the methodology presented in chapter 4 requires to be tested against problems which a classifier faces when classifying some compound subjects embodying scientific and technological advancements. The ease with which these problems can be solved can be construed as the merit of the scheme. To that end, subjects have been selected at random for classification from different sources and presented in this chapter. Worked-out examples have been so chosen as to represent a cross-section of subjects and diverse techniques used in classifying them. With a view to assess students who may be studying practical classification as a subject in their classes, some of the examples in this chapter have been selected from question papers set in the university examinations for the M.L.I.Sc. courses. Other examples have been so chosen from different abstracting journals as to represent a cross-section of subjects and deployment of appropriate techniques. As regards the worked-out examples, notes have invariably been provided in those cases where the method of formulation of class numbers is not self-evident. The sole purpose of this exercise is to arouse interest in all categories of users of the UDC Scheme.

In examples cited in the previous chapter, subjects of documents had been analysed into their constituent elements which had, in turn, been cast into a pattern set by the standard facet formula. Thereafter, these had been represented by individual elements which were subsequently merged to form a whole class

number. This number had subsequently been rendered brief by a set of devices like parallel divisions, final digits and elimination of facet indicators.

In this chapter, only the later part of this exercise, i.e., subject analysis will be shown against each example. The procedure will be as follows: the subject of a document will, first of all, be analysed into constituent elements which will then be represented by numbers. These individual numbers will subsequently be fused to yield the whole class number. Thus the entire exercise consists of analysis and subsequent synthesis of elements (or facets) of subjects, while these elements are represented by concurrent numbers both at the formative and final stages.

Again, it is stressed here that in actual practice, the entire exercise is done mentally, and only the end result in the form of whole class number written down. This applies to professionals and classifiers. But for students, who have to undergo examination it is suggested that before arriving at the class number, the subject analysis be done on paper. This practice, as may reasonably be expected, will help them to avoid missing links in the class number. The overall result will be the elimination of possible errors and arrival at the appropriate class number.

At this point, it may be interesting to note that the subjects set in university examinations usually contain facets reflecting place, time and form, the idea being to test the student's ability to intercalate respective auxiliaries in a correct sequence within a compound class number.

Table 2-3 have been appended at the end of this chapter. Table I displays auxiliary signs according to their respective categories. Table 2 shows the filing or listing order of documents bearing compound numbers. Table 3 indicates the internal order of auxiliaries within a compound number, and shows the way in which a compound number can be formulated with its auxiliaries reflecting different facets of the subject of a document.

The readers have come across the term 'document' in this book and elsewhere. The term has come into vogue during the

past few years. Broadly speaking, it includes all types of publications including books. The International Federation of Library Associations has defined the term as 'a work recorded in languages or by other means'.

### Examples and exercises

As stated in the preceding paragraphs, the following examples have been selected for illustrating the points discussed so far:

(1) The commonwealth conference on apartheid in South Africa, held in 1986 subject analysis:

Commonwealth Conference: Apartheid: South Africa: 1986

061.3(41-44)                      323.118 (680)                      "1986"

Class number:      061.3(41-33):323.118(680)      "1986"

(2) Effects of chemical fertiliser on the growth and development of high yielding variety (HYV) rice plants; case studies in experiments.

Subject analysis:

Rice plants: Variations, mutations: Fertilisers (artificial).

633.18                      581.5                      631.82

Class number:—      633.18:581.15:631.82

Note:— The exact number for the 'high yielding variety (HYV)' does not occur in the schedule; this variant is the result of mutation of rice plants.

(3) Technology of large-scale vacuum drying of corn flakes

Subject analysis:

Corn flakes: Vacuum drying: Mass production

664.784-8                      66.047.2                      658.526

Class number:      664.784.8:66.047.2:658.526

Note: The term 'mass production' can be considered as equivalent to 'large-scale production.'

(4) Steel for earthquake resistant structures.

Subject analysis:

Steel: Foundations resistant to earth tremors

691.714                      624.159.1

Class number:—      691.714:624.159.1



Note:— In this case, the number for the 'steel as metallic building materials' has been adopted.

(5) Energy spectra produced by the interaction of antiprotons with other particles.

Subject analysis:

Antiprotons: Interaction with other particles: Energy spectra

539.125.4                      539.12...17                      539.12...164

Class number:—                      539.125.417.164

Note:— It may be noticed here that the whole class number has been formed from the numbers 539.125.4.17 and 539.12.164.

(6) Review of dry land agricultural research in India during 1971-81.

Subject analysis:

Dry farming: Research in India during 1971-81: Progress Reports

631.586                      001.5(540)                      "1971/1981"                      (047.1)

Class number:—                      631.586.001.5(540) "1971/1981" (047.1)

Note:— the concept 'progress reports' can be considered as equivalent to the term 'review'.

(7) English language bibliography of research in strategic guided missile system of the U.S.A.

Subject analysis:

Strategic guided missile system: U.S.A: Bibliography: English language

632.462.14                      (73)                      (01)                      =20

Class number:—                      632.462.14(73)(01)=20

(8) Self-sealing tyres for use with police vehicles.

Subject analysis:

Police vehicles: Self-sealing tyres

629.114.476                      629.11.012.558.4

Class number:—                      629.114.476.012.558.4

Note:— The number 629.11.476 for police vehicles has been derived with the help of the parallel division 629.114 $\approx$ 629.1-4 as follows:

629.11.476

Police vehicles

from 629.11

### Road vehicles

and 629.1-476.

### Vehicles for police

(9) Incidence of encephalitis among infants of low-lying areas of Assam: A bibliographical study.

**Subject analysis:**

Encephalitis: Children: Assam, below level

616.831-002

-053.6

(541.1-197.2)

: Bibliographic description.  
(048.1)

Class number:— 616.831—002—053.6 (541.—197.2)(048.1)

Note:— The number for the low-lying areas of Assm has been formulated as under:

(541.1—197.2)

Low-lying areas of Assam.

from (541.1)

Assam

and (1-197.2)

Below level.

(10) Impact of informatics on vocational and continuing education in India.

**Subject analysis:**

Information work techniques: Vocational education: India

659.21

377.4

(540)

Class number:—

659.21:377.4(540)

(11) X-ray fluorescence geochemical analysis of rocks found on the surface of the moon.

**Subject analysis:**

#### Properties and structures revealed by X-radiography:

539.26

Physico-chemical petrology: Moon

552.1

523.3

Class number:—

539.26:552.1:523.3

(12) Expenditure over social insurance of the aged people in Great Britain during 1984.

**Subject analysis:**

**Expenditure: Social old-age insurance: Great Britain: 1984**

336.126.4

486.431

(420)

"1984"



(16) Social welfare schemes for leather industry personnel of Tamil Nadu: A bibliography.

Subject analysis:

Leather industry personnel: Social welfare scheme:

675-051	36.07
Tamil Nadu:	Bibliography
(548.1)	(048)

Class number:— 675-051:36.07(548.1) (048)

Note:— The number 675-051 has been formulated through the following process:—

675-051	Leather industry personnel
from 675	Leather industry
and -051	Persons as practitioners.

(17) Measurement theory and its application in library research.

Subject analysis:

Measurement theory: Library functions etc: Research

Class number:— 303.21:021.001.5

(18) Current research topics in clinical and community psychology (a bibliographical serial published in the U.S.A. since 1972).

Subject analysis:

Clinical and community psychology, research: In U.S.A.

159.91.922.27.07	(73)
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Class number:— 159.91.922.27.07(73) "1972/1986"

Note:— The following points may be noted here:

(i) The number for 'research in clinical and community psychology, has been formulated through the following process:

159.91.922.27.07	Research in clinical and community psychology.
from 159.91	Clinical psychology
and 159.922.27	Community psychology
and 159.07	Research in psychology



(22) A case study of factors relating to drug abuse and treatment results in selected high school students in Canada.

Subject analysis:

Narcotics: Treatment follow-up: School students

613.83	616-082.8	-053.5
	: Canada	: Reports of tests
	(71)	(047.3)

Class number:— 613.83:616-082.8-053.5(71) (047.3)

(23) Isolation and identification of thyroid hormones in the chicken.

Subject analysis:

Chickens: Thyroid gland hormones: Analysis, detection etc.

598.617	591.444.147	543.061
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Class number:—

598.617:591-444.147:543.061

Note:— The number for the 'thyroid gland hormones' has been synthesised through the following process:

	591.444.147	Thyroid gland hormones
from	591.444	Thyroid gland
and	591.147	Hormones.

(24) Applications of operations research in production planning, scheduling and inventory control.

Subject analysis:

Production planning: Inventory control: Operations research

658.5	658.787	65.012.122
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Class number:— 658.5.787.012.122

Note:— The digits 787 have been added to 658.5 because instructions for the application of special auxiliary subdivisions at 65 states that the numbers 65.01/.07 are valid under 651 and 657/659.

(25) Literature survey of sources of information for social security statistics.

Subject analysis:

Social security: Statistics: Information from primary documents

36	31	(048.8)
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Class number:— 36:31(048.8)

(26) Administrative Report of the Department of Police, Punjab Government, 1967.

Subject analysis:

Organisation of Police: Punjab: 1967: Administrative report  
351.741 (545.2) "1967" (047.3)

Class number:— 351.741(545.2)"1967"(047.3)

(27) Report on the ministerial level Decca-Delhi Conference on sharing of Ganges water, held in October 1976.

Subject analysis:

Peaceful settlement of disputes: India and Bangladesh

341.62 (540:549.3)

Ganges system: Surface water: October 1976: Report

(282.253.21) 628.113 "1976.10" (047)

Class number:— 341.62(540:549.3):628.113(282.253.21)  
"1976.10"(047)

Note:— The class number may seem rather long. It can be abbreviated by eliminating the number 628.113 which seem superfluous. The number will then be as follows:

341.62(540:549.3) (282.253.21)"1976.10"(047)

(28) Indian expedition to the Antarctica in 1984.

Subject analysis:

Geographical expedition: Antarctica: Indian people: 1984

310.3 (160.26-13) (=914) "1984"

Class number:— 910.3 (160.26-13) (=914) "1984"

(29) Supersonic testing of coupling rods of electrically operated industrial locomotives.

Subject analysis:

Industrial locomotive, electrically operated: Coupling rods:

629.423.15 62-232.1

Supersonic testing

620.179-16

Class number:— 629.423.1-232.1:620.179-16

Note:— The compound number 629.423.15 has been derived with the help of the parallel division  $629.423.1 \approx 629.421$  as follows:

629.423.15 Electrically operated industrial locomotive.

from 629.423.1 Electrical locomotive.

and 629.421.5 Industrial locomotive.

(30) Instruments for indicating direction for use in aircraft.

Subject analysis:

Aircraft with signalling and indicating devices

629.7.066

:Instruments indicating direction

629.7.054'844

Class number:— 629.7.066.054'844

Note:— The number 629.054,844 has been formulated on the basis of instruction given at 629.7.054 for denoting function by subdivisions of 629.7.058 replacing the digits by an apostrophe as shown below:

629.7.054'844 Instruments indicating direction

from 629.7.054 Instruments

and 629.4.058.44 Indication of direction

(31) Nomadic cultures of gypsies of Spain.

Subject analysis:

Nomadic cultures: Spain: Gypsies

903'15 (460) (=914.99)

Class number:— 903'15(460) (=914.99)

(32) Underwater photograph of Marine flora in Bahama sea.

Subject analysis:

Underwater photograph: Flora: Marine: Bahama sea

77.058.1 581.9 (26) (261.63)

Class number:— 77.058.1:581.9(261.63)

Note:— The auxiliary (26) can be omitted, and the number written as 77.058.1:581.9 (261.63).

(33) Nationalisation of banks in India, and its effect consequent on trade with other countries.

Subject analysis:

Nationalisation influencing foreign trade: Banking: India

339.544.025-87 336.71 (540)



Note:— The number 339.544.025.87 had been derived with the help of parallel division  $339.544.025 \approx 339.13.025$  as shown below:

	339.544.025.87	Influencing foreign trade by nationalisation
from	339.544.025	Influencing foreign trade by administrative measures
and	339.13.025.87	Nationalisation

(34) Fusion reactors using high-temperature rotating plasma.

Subject analysis:

Fusion reactors: rotating plasma type: High temperature plasma

621.039.629

533.921.6

Class number:— 621.039.629:533.921.9

Note:— The number 533.921.6 has been formulated through the following process:

	533.921.6	High temperature plasma
from	533.92	Plasma reactors.
and	533.9...16	High-temperature plasma.

(35) International treaty regarding the hunting of seals.

Subject analysis:

Hunting of seals: International agreement.

639.247.45.3

341.24

Class number:— 639.245.341.24

Note:— The number for "hunting of seals" has been formulated with the help of parallel division  $639.245/.247 \approx 599.5/.7$  as follows:

	639.247.45.3	Hunting of seals
from	639.24	Hunting of marine animals.
and	559.745.3	Seals

(36) Nationalisation of foreign trade by Socialist states—its effect on international economic situation.

Subject analysis:

Foreign trade: influenced by nationalisation: Socialist state

339.544.025.87

321.74

:Economic situation: International

338.1 (100)

Class number:— 339.544.025.87:321.74:338.1(100)

Note:— The number 339.544.025.87 has been obtained with the help of the parallel division  $339.544.025 \approx 339.13.025$  through the following process:

339.544.025.87 Influencing foreign trade through  
nationalisation  
from 339.544.025 Influencing foreign trade  
and 339.13.025.87 Nationalisation

(37) The 'project tiger' campaign in India, and its aftermath.

Subject analysis:

Tigers: Wildlife conservation and protection: India

599.742.7 502.2 (540)

Class number:— 599.742.7:502.2(540)

Note:— The title is not explicit, but its meaning is clear. In this example, the classifier has to interpret the subject by himself.

(38) Radiophoto transmission service through artificial satellites.

Subject analysis:

Radiophoto transmission: Artificial satellites

621.397.12 629.783

Class number:— 629.783:621.397.12

(39) Strategic bombing of anti-missile bases by laser-guided smart bombs: A defensive measure against aggression.

Subject analysis:

Aerial bombs, guided: by laser: Anti-missile system

623.451.74.55.027 621.375.826 623.764

:Destruction as means of defence

623.685

Class number:— 623.451.74.55.027:621.375.86:623.764.685

Note:— The methodology of the formulation of the number is given as follows:

623.451.74.55.027 Laser-guided aerial bombs  
 from 623.451.74 Aerial bombs  
 and 623.58.027 Guiding of missiles

Thereafter, the number for the last colonized part has been obtained by the same method, e.g.

623.764.685 Destruction of anti-missile system as a  
 means of defence  
 from 623.764 Anti-missile defence systems  
 and 623.685 Destruction as means of defence

(40) How effective is the protective gear for the skin against mustard gas in the event of chemical-warfare?

Subject analysis:

Protection of the skin: Mustard gas: chemical-warfare  
 614.898 623.459.45 623.4.083.4

Class number: 614.898:623.459.45.4.083.4

Note:— The number 614.898 has been formulated with the help of the parallel division  $623.459.61/.68 \approx 614.891/.898$

Thereafter, the colonized number has been formulated as indicated below:—

623.459.45.4.083.4 Mustard gas in chemical-warfare.  
 from 623.459.45 Mustard gas  
 and 623.4.083.4 Chemical-warfare.

(41) An insight into cytology of chromosomes through techniques based on electron microscopy.

Subject analysis:

Cytology of chromosomes: Electron microscopy

Class number:— 577'316: 537.533.35

Note:— The number 577'316 has been formulated with the help of the parallel division  $577'3 \approx 576.3$  as indicated below:

577'316 Cytology of chromosomes  
 from 577'3 Cytology  
 and 576.316 Chromosomes.

(42) The limitation of strategic arms through bilateral treaty between U.S.A. and U.S.S.R. on non-proliferation of nuclear weapons.

Subject analysis:

Nuclear weapons: Non-proliferation treaty: U.S.A. and U.S.S.R.  
623.454.8                      341.67.241                      (73: 47+57)

Class number: 623.454.8:341.67.241 (73:47+57)

Note:— The number 341.67.241 has been obtained by the method indicated below:—

341.67.241 Treaty for non-proliferation of strategic arms.  
from 341.67 Limitation (non-proliferation) of strategic arms  
and 341.241 Treaties.

(43) Mechanism for polyester/cotton blend dyeing

Subject analysis:

Polyester/cotton blends: Dyeing, mechanism for  
677.494.674.21-489                      677.047.4

Class number:— 677.494-674.21-489: 677.047.4

The auxiliary -489 can be shifted at the end, and the number can be written in abbreviated form as 677.494.674.21.047.4-489.

Note:— The number for 'polyester fibres' has been synthesised with the help of parallel division  $677.494 \approx 678$  as follows:

677.494.674 Polyester fibres.  
from 677.494 Synthetic fibres.  
and 678.674 Polyester polycondensates.

(ii) Thereafter, further synthesis takes place as follows:

677.494.674.21 Polyester-cotton blends  
from 677.21 Cotton  
and 677-489 Blends of fibres

(44) Automatic screen printing process—Japanese patent.

Subject analysis:

Automatic screen printing: Japan: Patents  
655.332-52                      (520) (088.8)

Class number:— 655.332-52(520) (088.8)

Note:— The number 655.332-52 has been formulated through the following process:

655.332-52 Automatically operated screen printing process

from 655.332 Screen printing

and 62-52 Automatically operated process

(45) Appraisal of inorganic phosphorus form acid soils of Nagaland.

Subject analysis:

Acid soils: Phosphorus: Quantitative soil analysis: Nagaland

631.415.2 631.416.2 631.423 (541 NAG)

Class number:— 631.415.2.416.2.423 (541 NAG)

(46) Natural gas from underground coal gasification-prospects and utilisation.

Subject analysis:

Coals: Underground gasification: Extraction of natural gas:

622.333 622.278 622.279

Direct Utilisation

.002.82

Class number:— 622.333.278.279.002.82

It is clear that the class number has been synthesised with the help of end digits of individual numbers.

(47) Calibration of tensile testing machines.

Subject analysis:

Tensile strength: Testing machines and apparatus:

539.412 620.1.05

Regulation of Instruments

681.2-5

Class number:— 539.412 :620.1.05:681.2-5

(48) Scattered gamma radiation measurement in industrial radiography.

Subject analysis:

Scattering of gamma radioactivity: Measurement using discharge phenomena

539.166.171 681.2.082.77

Class number:— 539.166.171.2.082.77

Note:— (i) The number 539.166.171 has been formulated through the following process:

539.166.171 Scattering of gamma radioactivity  
 from 539.166 Gamma radioactivity  
 and 539.171 Scattering

(ii) Thereafter, the number 681.2.082.77 has been formulated with the help of parallel division 681.2.08  $\approx$  53.08 as follows:—

681.2.082.77 Measurement using discharge phenomena (X-ray etc)  
 from 681.2.08 Principle of measurement  
 and 53.082.77 Measurement methods using discharge phenomena

Note:— As the number 68 denotes industries, the colonised number 681.2.082.77 is appropriate to the concept of measurement in industrial radiography.

(49) Geophysical exploration for uranium in Salem district, Tamil Nadu.

Subject analysis:

Uranium: Geophysical prospecting and exploration: Salem district (Tamil Nadu)

Class number:— 546.791:550.81(548.1 SAL)

(50) Ministerial meeting of the GATT (General Agreement on Tariffs and Trade) held in Uruguay in 1986.

Subject analysis:

GATT: Uruguay: 1986  
 339.54:061.1(100) (899) "1986"

Class number:— 339.54:061.1(100) (899) "1986"

Note:— (i) The number for the GATT has been formulated through the following process:

339.54:061.1(100) International agreements on trade policy (GATT).  
 from 339.54 Foreign trade policy, Instruments  
 and 061.1 International organisations  
 and (100) International

The final number can be abbreviated by omitting the auxiliary denoting form because this facet is implicit in 061.1; then the number can be written as 339.54:061.1(899) "1986"

(51) International Conference on human rights of disabled children, 1979.

Subject analysis:

Human rights:	Disabled children:	International Conference:
342.7	-56.266-053.2	061.3(100)
	New York:	March 1979
	(747)	"1979.03"

Class number:— 342.7-56.266-053.2:061.3(100)"1979"

Note:— The number for the 'disabled children' has been formulated through the following process:

-56.266-053.2	Disabled children
from -56.266	Permanently disabled persons
and -053.2	Children and infants

The appropriate devices, processes and techniques which are deployed for practical classification have been discussed in this chapter. Now, an interesting aspect of the UDC need also be cited. There exist fine nuances between apparently identical concepts which can be expressed through built-up auxiliaries. The common auxiliaries of language, race and nationality, and place are related to the extent that these can be inter-woven to denote distinctive shades of a subject. The inter-linking of these auxiliaries which bring these features to the surface is of considerable significance in classification practice. The shades of meaning of subject as are revealed by such devices are shown through the following examples:

(52) Education of the Greek-speaking people in Turkey.

Subject analysis:

Educational guidance:	Greek-speaking people:	Turkey
37.04	(=774)	(496.1)

Class number:— 37.04(=774) (496.1)

Note:— Here, the nationality or ethnic aspects of a subject represented by a main UDC number has been denoted by

common auxiliaries of race and nationality. These numbers, derived from the common auxiliaries of language, distinguish linguistic-cultural groups from the political nationality (or citizenship).

(53) Population statistics of the Greek nationals in Turkey.

Subject analysis:

Population statistics:	Greek nationals:	Turkey
312.05	(=1.495)	(496.1)

Class number:— 312-05(=1.495) (496.1)

Note:— The numbers (=1.4/.9), which are derived from place auxiliaries denote political nationality (i.e. citizenship) of nation-states. The place auxiliaries, table 1(c), can, however, be used to express the same concept.

(54) Turks residing as voluntary emigrants in French Algeria.

Subject analysis:

Voluntary emigrants:	Turks:	French Algeria (historical).
325.252	(=943.5)	(65=40)

Class number:— 325.252 (=943.5) (65=40)

Note:— Ethnic zones, i.e., place with reference to race, can be denoted by details from the common auxiliaries of race and nationality. The following examples will explain the methodology:

	(65=40)	French Algeria (historical)
from	(65)	Algeria
and	(=40)	French people.

The major utility of a classification scheme rests on the feasibility of its use for the ISR (Information Storage and Retrieval System). The attention will, therefore, now be focused to indexing and retrieval languages, which though peripheral, is as important as the classification itself. The reason is apparent. Unless the notation (or digits) have been translated in terms of words of everyday use, there exists little possibility of using them for any ISR system. The next chapter will, therefore, be devoted to devising an indexing system which will be appropriate and adequate for an UDC classified file.



TABLE 2

Filing or listing order of compound UDC numbers Less restrictive to more restrictive		
	Auxiliary signs	Significance
+	(plus)	for coordination, addition.
/	(stroke)	for consecutive extension
0—9		simple main number
:	(colon)	for relation
[ ]	(square brackets)	for subgrouping
::	(double colon)	for order-fixing
=		Language
(0...)		form
(1/9)		place
(=...)		race
" "		time
A/Z, 1 to ...		non-UDC numbers
.00		point of view, materials and person
—1/—9 hyphen series		denote recurring concepts
'01/'09 point-nought series		
'1/'9 apostrophe series		

Note:— The common auxiliaries 'place' may follow 'time' in filing order if the former is considered more restrictive.

TABLE 3

Internal order of auxiliaries in a compound UDC number More restrictive to less restrictive		
	Auxiliary signs	Significance
0,9		Simple main number
'1/'9 apostrophe series		denote recurring concepts
'01/'09 point-nought series		
—1/—9 hyphen series		
A/Z, 1 to ... non-UDC numbers		
(1/9)		Place
(=...)		race
" "		time
(0...)		form
=		language

Note:— The common auxiliaries of 'place' and 'time' are interchangeable if the latter is considered more restrictive.

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## **RETRIEVAL SYSTEMS**

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## Retrieval Languages

### Classified file

So far, the theoretical concept of the UDC has been discussed followed by the methodology of classification practice, the purpose being to classify the documents so that they could be arranged systematically according to their respective disciplines ordained by class numbers and be retrieved easily. But class numbers, which consist of digits, convey their significance only to those who are familiar with the classification schedule. For them, these numbers have to be interpreted in terms of words which are comprehensible to all. As already mentioned before, class numbers of compound subject have several facets each of which needs to be represented by words (or terms). If each facet is reflected through a set of terms, then different facets of the same subject will need different combinations of terms, and it is the indexing system that decides the pattern of combinations. Thus, the technique of indexing mainly rests on the appropriate permutations and combinations of terms. It is different from the traditional form of library cataloguing where a subject heading conveys the intrinsic meaning of the subject of a document provided the terms employed are specific and not nebulous.

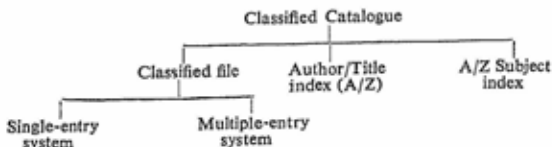
As is known, the traditional form of information retrieval in libraries is done with the help of catalogues which have several forms and formats. One of these is the classified catalogue which consists of three parts, i.e. classified file, Author/Title index (A/Z), and A/Z subject index.

In the Author/Title index (A/Z), the entries, prepared according to names of authors and titles of documents, are filed in alphabetical order. The users should know at least



one of these indications to locate the document. The index is generally kept separate from the A/Z subject index.

This retrieval system can be represented through the following diagram:



In a conventional storage and retrieval system of a library collection, the Author/Title index (A/Z) is prepared generally on the basis of instructions contained in the Anglo-American Cataloging Rules (AACR). The subject headings for the A/Z Subject index can be obtained with the help of printed lists or pre-coordinate indexing systems like chain index, Preserved Context Indexing System (PRECIS), Cyclic index etc. These systems have, hereafter, been described in detail.

In a classified file, entries representing the subjects of documents are arranged according to their class numbers. But, the significance of these numbers are not known to the users who are generally familiar with words (or terms). What they need is an alphabetical guide to contents of the classified file. This purpose is served by the A/Z subject index which is a guide to the classified file because it is the key to the location of a topic, and is a reference to the names of subjects from their numbers.

When a retrieval system to any collection of documents denoting compound and complex subjects has to be prepared, the scenario changes. In such cases, a specific subject heading will not do. Instead, an array of index entries are needed where the terms are specified as keywords. The alignment of keywords will so variate as to bring each of them to the forefront through selective rotation. This rotation, which should be logical, can be done by computers much faster than a manually operated process. Many of the libraries and information centres will now be acquiring personal computers which

are ideally suitable for the operation. So, the time has come for the adoption of computerised processes.

The field of indexing being wide and choice difficult, the users naturally want a system that will work. They will do well to adopt the cyclic indexing system. Before that, they need to be aware of its logical base and advantages. The next few pages will, therefore, be devoted to the description of a few existing indexing systems before attention is focused on the cyclic indexing. Before that, chain indexing will be discussed in all its details to find out why it cannot be used for constructing A/Z subject index to an UDC classified file.

### **Chain indexing**

There are quite a few practices in vogue at present for preparation of alphabetical subject index to a classified file. Chain indexing, PRECIS of recent origin and cyclic index of UDC classified file are familiar examples. While other indexing systems have their own advantages, they are not altogether free from drawbacks.

Chain indexing in a single-entry system (which will hereafter be simply referred to in this book as chain index) can also be used for construction of A/Z subject index to a UDC classified file.

The chain indexing is generally claimed to possess two basic advantages i.e. (1) it is systematic and a relatively mechanical system wherein all "sought" keywords are consistently cited as entrywords in index entries, and (2) it is economical because many of the index entries serve as channels to the subjects which are filed in classified sequence and need not be indexed.

The foregoing assumptions will now be tested against the perspective of an UDC classified file.

In a single-entry system, the UDC number is generally constructed with the help of special auxiliaries in preference to facet indicator. The main entry with this class number will file at only one place in the classified file, e.g.

616.24-005-085      Therapeutic measures for the prevention of haemorrhage in tuberculosis.

The classified file will have one entry at 616.24-005-085.

In chain index, the UDC class number is an integrated whole and the chain of the whole number is indexed. The following typical example illustrates the general disadvantages of chain indexing wherein the need for dropping 'unsought' terms to secure economy has also been displayed.

#### Example

Operation of carburettor of piston engines.

621.432.033-5

Entry in classified file at: 621.432.033-5

Chain

621	Mechanical engineering
621.4	Unsought link
621.43	Internal combustion engine
621.432	Piston engine
.03	Unsought link
.003	Carburettor
-5	Operation

Index entries:

Operation: Carburettor: piston engine: internal combustion engine

Mechanical engineering 621.432.033-5

Carburettor: piston engine: internal combustion engine

Mechanical engineering 621.432.033

Piston engine: internal combustion engine:

Mechanical engineering 621.432

Internal combustion engine: mechanical engineering: 621.43

Mechanical engineering 621

Only the primary index entry with full length chain represents the whole class number 621.432.033-5, which is the actual class number of the document. This primary index entry is a direct entry pointing to the actual document, whereas the rest of the index entries are merely channels to it and also to others.

The terms internal combustion and other special engines (621.4) air, fuel and carburation are considered as 'unsought' links and dropped for economy. Chain indexing is claimed to be a mechanical process. But leaving out unsought terms is a matter for decision which has to be taken by the indexer and this goes against the mechanical characteristics of chain indexing.

Also, the primary direct entry at full length chain, containing all the components starts with an abstract term 'operation' as entryword which is unlikely to be sought while searching for this document.

A search for an information is generally made with a sequence of words starting from the most concrete to the most abstract. A class number is also built up along the same lines. Chain indexing is, no doubt, the classified sequence, but index entries are formulated in reverse order. The primary index entry with full length chain starts from the least concrete element, and sometimes with unsought components. This cannot be considered a helpful approach.

The chain indexing is said to be economical; but this economy is achieved by not taking qualifiers of entry words from below those used in the chain. So, when an abstract term becomes an entry word, the less abstract term should act as a qualifier. But, this can be brought about by an exceptional transposition of unsought terms which is unwarranted.

In chain index, how transposition of unsought terms is resorted to is illustrated in the following examples. By transposition, is meant interchange of position between the sought (concrete) and the unsought terms (abstract). Example:

Charging: diesel engine	621.436.031
Combustion: piston engines	621.432.019
Control: rocket engines	621.455-5
Efficiency: Rocket engines	621.455.018
Performance: Gas turbines	621.438.018
Power: gas engines	621.433.018
Preheating: diesel engines	621.436.036



The last link in the above class numbers produces primary index entries with an abstract term which is also an unsought term. This is remedied through the transposition of the abstract term in the following manner:

Diesel engines: charging	621.436.031
Diesel engines: preheating	621.436.036
Gas turbines: performance	621.438.018
Gas turbines: power	621.433.018
Piston engines: combustion	621.432.019
Rocket engines: control	621.455-5
Rocket engines: efficiency	621.455.018

Obviously, a change in the sequence of abstract terms is necessary for information retrieval. But, this operation involving an exceptional transposition of terms transgresses the rule of chain indexing. Faced with such a contradictory situation, the indexer naturally finds himself in a predicament.

Unsought links do occur if a consistent mechanical procedure of indexing is followed. Such unsought links have to be dropped to secure economy. This step of dropping unsought links and choice of suitable qualifiers imposes decision on the part of the indexer and the assumed mechanical character of the chain indexing thereby loses its significance. Moreover, an unsought link of today may become a sought link (i.e. keyword) of tomorrow. Chain indexing is stated to be economical in that, many of the index entries are merely links to the subjects focused in the classified sequence, and that index entries which are common to one and the same subject are not repeated. Economy, thus brought about, may be possible in a large file devoted to a specific subject field, but in case of a comparatively smaller file with several subjects represented in it, many of the links may remain open for long, awaiting to be used as paths to similar subjects. In such a situation, chain indexing cannot be regarded as economical. The contention that the empty links are used or get linked when appropriate subjects come up for indexing is largely hypothetical.

Chain indexing uses terms provided in the classification schedule. It is likely that some of the terms given in the

schedule may not be current as new terms are being coined with advances in science and technology. It may become necessary for the indexer to substitute obsolete terms with current ones or to use cross reference entries. This imposes a burden on the indexer.

Modifications to UDC numbers through P-notes, issued by FID create new class numbers and sometimes amend old ones. Extensions and corrections to the UDC Series, 5, No. 6, FID Publ. No. 248/5 : 6 September 1965, and the whole series of P-notes prior to it amplify this point. All the chain index entries, constructed on the basis of such outdated class numbers, which serve as links to the related subjects, have to be discarded because their continuance becomes unwarranted.

A special instance can be cited. The UDC BS 1000A : 1961 does not contain any class number for electronic computers. It is likely that documents on this subject might have been classified under 681.177 and chain indexed against this class numbers in many libraries. But now this subject has been assigned the class number 681.3. This change will obviously throw all index entries based on 681.177 into disarray.

Sometimes it is difficult to assign co-extensive class number to documents dealing in certain specific subjects including newly developed ones i.e., anabiosis, antiparticles, biophysics, biomechanics, laser, machine translation, maser, gerontology etc. Such examples can be multiplied to any extent. In such cases chain indexing on the basis of terms consistently derived from its class number will create anomalies. This can, however, be avoided only by indexing the subject through its constituent components. The reason is not far so seek. A depth classification scheme which can fully identify any complex subject on a notational plane has yet to be developed. This has now led to attempts at subject indexing without the help of class numbers. Words may succeed to identify a subject where numerical notations fail.

In contrast to UDC, the terms in colon classification are grouped together according to the facet formula PMEST, and the sequence in which the facets have to be cited are laid down. For successful working of chain indexing, it is necessary that

(i) the class number should be co-extensive with the subject, and (ii) the class number should be consistently built up from the base, and gradually in stages from the most concrete to least concrete aspect without any missing link in between them. Such a perfection is difficult to attain in any classification scheme. Excepting the full length index entry, none of the entries is found to be co-extensive to the subject while others stand for broader classes. Further, if the subject of a document is a specialised one, a number of empty links in the chain is generated.

Later, realising the drawbacks of the chain indexing, Ranganathan had felt that the facet analysis is sufficient by itself for the generation of subject headings as is done in a dictionary catalogue.

One of the major drawbacks of chain indexing is its inadequacy as an information retrieval tool. This fact can be demonstrated through chain indexing a complex subject. For example, chain index entries of a set of documents on torsion tests conducted on different categories of alloy steel will yield the following index entries:

Torsion tests: acicular: high-carbon ferrous alloys: alloy steel

Torsion tests: austenitic: low-carbon ferrous alloys: alloy steel

Torsion tests: eutectoid: high-carbon ferrous alloys: alloy steel

Torsion tests: ferritic: low-carbon ferrous alloys: alloy steel

Torsion tests: ferritic: high-carbon ferrous alloys: alloy steel

Here, the term "alloy steel" is the most concrete while 'torsion tests' the least. But, in order to locate information of alloy steel one has to go through the tiresome process of scanning all the entries till he encounters it at the end. This happens because the least concrete term, which forms entry-word in all the chain index entries, becomes the first qualifier and is filed as such in an alphabetical sequence.

Besides, the dictionary catalogue is an anachronism in the present context of information retrieval through indexing because the subject headings, in a dictionary catalogue are selected with the help of printed list of subject headings which cannot keep pace with the advancing frontiers of knowledge,

and get obsolete soon after they are published. There exist other problems also. The chain indexing procedure is not quite capable of rendering digit by digit translation of class numbers of newly emerging subjects. But, this is essential for deriving subject headings. The reason is obvious: chain indexing, being primarily intended for use with CC (Colon Classification), rests on a classificatory base, and there is no foundation to keep the CC up-to-date. So, the notation of the scheme is not without its limitation. Even if it is assumed that a complex subject is represented by co-extensive class numbers, the problem will not end there, because complex subjects with co-extensive class numbers, when chain indexed, yield inconveniently long index entries, e.g. the example of such a subject is given below:

Field strength of beam guiding electromagnet for plasma betatrons

UDC no. 621.384.637 : 621.3.038.615 : 621.318.3 :  
621.304.095

The chain indexing of such complex numbers is done by maintaining multiple-entry system which implies that each coloned number has to be separately indexed. This results in an expanded classified file with its filing order in disarray. The incompatibility of chain indexing of an UDC classified file can thus be visualised.

Due to its limitations, chain indexing was not able to hold its ground for long. In course of time, its drawbacks were exposed and then new ideas were sought.

These limitations that constitute in-built disadvantages of the system need elaboration here only to show that the proposal for using the chain indexing, as envisaged in the 'Guide to the UDC BS 1000C (1963)' needs to be shelved in favour of cyclic indexing which will hereafter be discussed.

To summarise the disadvantages of the chain indexing, it may be stated at the outset that this system, which had been devised for generating subject headings, ceases to be effective due to the problem of disappearing chain which can be remedied through an exceptional transposition of unsought terms as

has been explained earlier. But this breaks the most fundamental rule of chain indexing which stipulates that qualifiers of an entry word must not be taken from below that word in the chain. Thus the drawback of the chain indexing system lies within its configuration. It is apparent that an information retrieval system needs some other techniques where the transposition of terms is not bound down by a rigid stipulation.

As the traditional systems of indexing cannot keep the deluge of information at bay, it is necessary to find out some methods based on keywords which can be manipulated by computers and printed by it.

Visualising the scenario as a whole, one can understand that the lack of speed of the traditional library methods of subject indexing to cope with current information explosion has given rise to new techniques which depend upon high speed mechanised manipulation of keywords to generate dissemination indexes like KWIC, KWOC and their variations. The effectiveness of the recall ratio of these mechanised indexes is yet to be evaluated, but the fact they are being used in renowned abstracting journals like Chemical Abstracts, Biological Abstracts etc. indicate that they have come to stay. Fast communications in the form of papers etc., published in journals have to be processed for dissemination and subsequent retrieval. That is why these mechanised indexes, although not conforming to the basic principles of subject indexing as enunciated by Cutter, Kaiser and others, have been accepted for the sake of their speed. The time has arrived for the indexers to realise that rigid adherence to conventional methods has stultified the techniques originally connected with the library science to the verge of immobility. But, things have inexorably started changing. The conventional catalogue of yore has undergone radical transformation. The consolidated cataloguing rules, passing through gradual evolution from the Anglo-American Rules (1908) to its present form in Anglo-American Cataloging Rules (AACR). Ed. 2 (1978), is based on the General International Standard Bibliographical Description (1975), which in turn, has its roots in ISBD (1971). This

ISBD (G), providing a single framework for the description of all types of publications, has been used as the basis for the aforesaid AACR which, though widely used, is not an internationally agreed code. Analogically, the indexing system of the past has also to change.

The emergent need of the hour is to devise an indexing system which will work well with manual process, and at the same time be suitable for mechanical manipulation. The successful application of electronic digital computers for rapid generation of large number of index entries is an advantage which has to be fully utilised. This implies that the keywords have to be manipulated mechanically and yet meaningfully. Besides, the transformation of index entries into different patterns should conform to certain logical principles. This will not only avoid the inconsistencies, but establish the system on firm ground in conformity with the principles of indexing. To eliminate the problems posed by synonyms, homonyms etc., the keywords have to be cast in proper form with the help of an authority file or thesaurus.

To cope with the problem of indexing, a number of indexing systems have been developed by Coats, Farradane, Sharp, Austin and others. Notable among these systems are the SLIC indexing, the practice followed by the British Technology Index and PRECIS. Among these, the PRECIS needs to be described in detail because the system has replaced chain indexing which was previously followed in the British National Bibliography. It is now used with the Australian National Bibliography also. Now, for the compilation of alphabetical subject index to the classified part, chain procedure based on the Dewey Decimal Classification (DDC) number had been adopted by the British National Bibliography. But the contents of documents could not be fully represented by class numbers, and so this indexing system was found to be ineffective. Then, the PRECIS (Preserved Context Indexing System), developed by Derek Austin in 1971, replaced chain indexing.

### **PRECIS**

The PRECIS had been developed for use with the DC classified file, and so the possibility of its application in

conjunction with the UDC need not be explored. Yet the principle of rotation of its terms that forms an essential feature of the system may be explained, the reason being that an identical concept forms the basis of cyclic indexing.

The procedure is, first of all, to analyse the basic concepts representing the subject of a document. These concepts are translated into indexing terms with the help of two vocabularies; one covers the entities, the other, attributes. The entity is given preference, while vocabulary terms are hierarchically organised and selected relevant terms cited in a predetermined order. The role operators make explicit the relationship between elements in the compound. After the selected terms have been cited and operators added, the matter is coded for machine manipulation.

To illustrate the point, the following subject may be considered:

Automatic cable testing equipment for trunk cable lines.

The subject is analysed, and the string constructed as follows:

Trunk lines—cable—automatic equipment—testing.

Here the terms of the string have been aligned in a context-dependent order where each term is directly related to the next term in the string.

The PRECIS format consists of two-line, three part (i.e. LEAD-DISPLAY-QUALIFIER) format. The entries are generated by the principle of shunting. The string for the subject will be as follows:

## LEAD

## QUALIFIER

Trunk lines. Cable. Equipment. Automatic testing

The first term of display is shunted to the LEAD position each time repeatedly resulting in the following set of entries:

Trunk lines

Cable. Equipment. Automatic testing

Cable. Trunk lines

Equipment. Automatic testing

Equipment. Cable Trunk lines

Automatic testing

Automatic testing. Equipment. Cable. Trunk lines

In PRECIS, role operators are used for ordering of component terms of a composite subject. The role indicators of the PRECIS help in aligning index terms into groups in the same way as terms are grouped into facets.

### **Cyclic indexing**

Foskett had suggested a modification to chain procedure with the stipulation that when rotation of facets is not possible in a classification scheme, the rotation of terms is the other way out. This procedure, known as the cyclic or permuted indexing, results in every entry being complete and compact.

The application of cyclic indexing is expected to eliminate the drawbacks of conventional systems. As the speed is essential in modern times, the adaptability of the cycle indexing system to computerised manipulation is an advantage which classical methods did not possess. The methodology underlying the system, which is speedy and effective, has been developed to such an extent that it can now be successfully used to generate subject headings for an UDC classified file for a collection of documents (which need not necessarily be a library) and also ordering of subject matters in bibliographies, abstracting and indexing serials, trade catalogues etc.

Before arriving at the final configuration of cyclic indexing, the successive stages through which the system has been developed need to be described. Initially, the method of cycling order of indexing in a multiple-entry system for the construction of A/Z subject index will be explained. As will be evident from the end result, the innovative feature of the scheme is based on the proposal for a modification of the order involving both clockwise and anti-clockwise rotation of components for generating an additional index entry.

The Guide to the UDC BS 1000C (1963) suggests the following methods for construction of A/Z subject index:





- (C) 621-5 Control (operation): 621.436 Diesel engine  
3  
(whole thing): 621.43.038 (of) Fuel injection system  
1  
(part)  
2

The three coloned parts in the example are capable of being cited in several ways. The UDC BS 1000C recommends only three permutations for the sake of economy. It further recommends that standard citation order of components should be according to the "standard" citation order or facet formula which has been described in detail in chapter 4, and so it need not be repeated here.

The facets, which are produced when a subject is analysed, are represented by respective keywords or components. When arrangement of these components follows the pattern of most significant to least significant as in the case of cited formula, it is then said to conform to the 'standard' citation order and forms the primary index entry in this system. The citation order as referred to is stated to be a 'standard' one because due to its logical nature and absence of bias towards any particular collection or group of users, it can be universally applied to any subject, compound or complex, to produce a helpful order of the elements. In the cited examples, each subject has been analysed into three facets which, irrespective of their positions in the citation order, have been denoted by numerals in an increasing order 1, 2, 3 here. It then follows that component 1 is more closely related to component 2 than to component 3. Such being the case, components 1 and 2, or 2 and 1 are considered as a closely-woven entity. Hence, those index entries, wherein component 3 comes between 1 and 2 or 2 and 1 and separates them, are not in keeping with the 'standard' citation order. These index entries are rejected in the process. In the given example, only three facets i.e., whole-body, part and operation are represented.

If the citation order of components in an index entry is not consistent with the 'standard' citation order, the rules provide for necessary realignment of components to make it significant. The index entry 2 : 3 : 1 at B does not conform to standard.

citation order because 3 Control (operation) comes between 1 Diesel engine (whole thing) and 2 Fuel injection system (part). As suggested in the system, the citation order has to be changed as 2 : 1 : 3. The final index entries will then be as follows:

621.436 Diesel engine (whole thing): 621.43.08 (of)  
1

Fuel injection system (part): 621-5 Control  
2  
(Operation)  
3

621.43.038 (of Fuel injection system part): 621.436  
2

Diesel engine (whole thing): 621-5 Control  
1  
(Operation)  
3

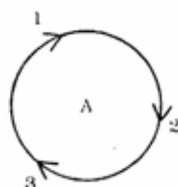
621-5 Control (operation): 621.436 Diesel engine  
3  
(whole thing): 621.43.038 (of) Fuel injection system  
1  
(part)  
2

In none of these three index entries, are the components arranged as in the index entry with full-length chain in the case of chain indexing in a single-entry system. An index entry with such an alignment of components will be a valuable one. The new method suggested in this paper, which provides such an index entry, is explained below with an example.

Control of fuel injection system of diesel engine. In a single-entry-system, entry in classified file will be at 621.436.038-5

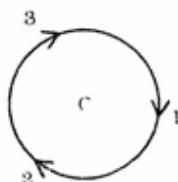
The three components of this subject when arranged according to standard citation order will be 1 Diesel engine (whole thing): 2 (of) Fuel injection system (part): 3 Control (operation). They are subjected to both clock-wise and anticlock-wise rotations. The following permutations are produced:

A Diesel engine (whole  
thing): of Fuel Injection  
system (part): Control  
(operation)



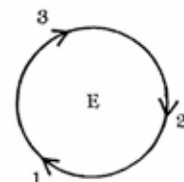
B of Fuel injection system  
(part): Control (opera-  
tion): Diesel engine  
(whole thing)

C Control (operation):  
Diesel engine (whole  
thing): of Fuel injection  
system (part)

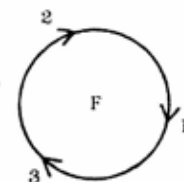


D Diesel engine (whole  
thing): Control (opera-  
tion): of Fuel injection  
system (part)

E Control (operation): of  
Fuel injection system  
(part): Diesel engine  
(whole thing)



F of Fuel injection system  
(part): Diesel engine  
(whole thing): Control  
(operation)





### (2) Index entries

Thoracic surgery, chest: complications, prevention of: post-operative care

Post-operative care: thoracic surgery, chest: complications,  
 3 1 2  
 prevention of

Post-operative care: complications, prevention of: thoracic  
3 2 1  
surgery, chest

Complications, prevention of: thoracic surgery, chest: post-operative care

- (2) Assembly of transmission system of direct petrol injection type engines 621.437.6-242-72

### Citation order

Engine-direct petrol injection type (whole thing): *of*  
1  
transmission system (part): assembly (operation)  
2 3

### Index entries

Engine-direct petrol injection type: of transmission system:  
assembly

Assembly: engine-direct petrol injection type: of trans-  
mission system

Assembly: of transmission system: engine-direct petrol  
3 2 1  
injection type

of Transmission system: engine-direct petrol injection type:  
2 1  
assembly  
3

- (3) Lubrication of reciprocating pistons of oscillating piston engines 621.437.6-242-72

*Citation order*

Engine—Oscillating piston type (whole thing): <sup>1</sup>of reciprocating piston (part): <sup>2</sup>lubrication (operation) <sup>3</sup>

*Index entries*

Engine-oscillating piston type: <sup>1</sup>of reciprocating piston: <sup>2</sup>lubrication <sup>3</sup>

Lubrication: <sup>3</sup>engine-oscillating piston type: <sup>1</sup>of reciprocating piston <sup>2</sup>

Lubrication: <sup>3</sup>of reciprocating piston: <sup>2</sup>engine-oscillating piston type <sup>1</sup>

of Reciprocating piston: <sup>2</sup>engine-oscillating piston type <sup>1</sup>lubrication <sup>3</sup>

- (4) Remote control of guided missiles by pulse-modulated radar systems. 623.462-519 : 621.396.962.3

*Citation order*

of Guided missile (whole thing): <sup>1</sup>by pulse-modulated radar <sup>2</sup>system (process): remote control (agent) <sup>3</sup>

*Index entries*

of Guided missile: <sup>1</sup>by pulse <sup>2</sup>modulated radar system: remote control <sup>3</sup>

Remote control: <sup>3</sup>of guided missile: <sup>1</sup>by pulse-modulated <sup>2</sup>radar-system

Remote control: <sup>3</sup>by pulse modulated radar system: of <sup>2</sup>

guided missile

1

by Pulse modulated radar system: of guided missile:

2

1

remote control

3

- (5) Researches on the application of supersonic vibrations to submarine detectors. 623.983:534-8.001.5

#### *Citation order*

Submarine detector (whole thing): supersonic vibration,

1

2

application of (process): research (agent)

2

3

#### *Index entries*

Submarine detector: supersonic vibration, application of:

1

2

research

3

Research: submarine detector: supersonic vibration, appli-

3

1

2

cation of

Research: supersonic vibration, application of: submarine

3

2

1

detector

Supersonic vibration, application of: submarine detector:

2

1

research

3

The prepositions 'by', 'of' etc., are ignored during alphabetisation of entries.

Thus, it is evident that this method, which is based on cyclic rotation of components and elimination of certain index entries according to a logical principle, combines the advantages of cyclic indexing in a multiple-entry system and chain indexing in a single-entry system.

Following the principle of decreasing concreteness of elements in formulating a class number of subject, more concrete facets of the same subject are cited before the less concrete ones in its facet formula which follows the same classificatory sequence.



The method is further explained below:

The descriptors (or keywords), representing diverse facets of the subject, are rotated in clockwise pattern to create a set of index entries in a rotated A/Z index.

When the system deals with 3 descriptors, the secondary entry, which is found not in agreement with the 'standard' citation order, is realigned to conform to the same. The system, thus evolved and being an extension to the rotated A/Z index, is known as cyclic index.

But coloned parts of the class number of the subject follow the same pattern of clockwise rotation in both rotated A/Z and cyclic index.

In cyclic index, all index entries are made to be consistent with 'standard' citation order so that the rotated A/Z index entries which follow a different sequence other than the cited one are not in conformity with the aforesaid order.

The implications that arise when chain indexing is operated in a single-entry system is well worth discussing.

So far as chain index is concerned, the whole class number in single-entry system, representing the integral subject, is indexed. But complex subjects generally get long class numbers, specially when the UDC scheme is used. Indexing of such subject leads to scattering of their parts. Multiple-entry system is adopted to minimise the scatter by indexing component class numbers (which are separated from one another by colon) separately. This reduces the subject scatter and lessens the load on alphabetical index. But, since the class number gets multiple entries under each of its components in the classified file, the economy, supposed to be induced by multiple-entry system, is substantially nullified because the classified file swells up disproportionately in the long run.

Moreover, the multiple-entry system is economical with chain indexing when it is applied to a specialised file comprising analogous subjects; but the case will be different when the conditions are reversed. The reduction of the number in A/Z index depends on the factor that when some class number components, which are common to those of integral class

numbers of other analogous subjects in the classified file, are not indexed again. A subject, however complex, is expressed by a helpful arrangement of concepts underlying it. In chain index, an isolated concept in a chain will lead to the class number of the subject and then to the document itself, e.g., index entry—component class number—whole class number of the document itself.

In a cyclic index, an association of concepts in an index entry and no concept can be isolated to denote it. All component terms, representing diverse aspects or facets of a subject, are placed together within an index entry wherein their positions vary according to a prefixed pattern. Also no component class number can be taken out of the integral class number here for indexing it separately. Since no chain indexing of a part or whole of the class number of any subject is involved, there is need to maintain a multiple-entry system only for the purpose of isolating component class numbers out of the whole class number for chain indexing them by turn.

On the basis of UDC BS 1000C (1963), it is assumed that each distinct UDC number has several document entries under it in the classified index, this means that single-entry in the classified file plus rotated A/Z index would still be more economical in size of total index.

This is also valid for cyclic index because it is apparent from foregoing discussions that cyclic index is a variation of rotated A/Z index.

Also in single-entry system, some concepts can sometimes be denoted by special auxiliaries in place of colon. This introduces a further element of economy in the form of contracted UDC numbers.

### **Semantic problems**

A simple orientation of descriptors may sometimes not be adequate to elaborate the idea of a complex subject and it will be necessary to make relationships between these terms (descriptors) explicit.

In co-ordinate index, which operates on almost the same principles as faceted classification, links, roles and weights are

used to solve syntactical problems. Weights are, however, a relatively new device which were proposed as replacements for roles. It needs mental efforts to analyse a subject and load uniterms with these symbols both at the input and IR (information retrieval) stage. But, this is essential for operation of the process.

In a non-inflected language like English, prepositions can be used for loading of descriptors to denote their inter-relationships. No such problem would, however, have arisen in case of a heavily inflected language like the Russian language. The prepositions can be underlined or put within brackets to differentiate them, otherwise anomalies may arise in certain cases, for example:

'invertebrates' and '*in* vertebrates'

An example of descriptors, loaded with prepositions, in a cyclic index will demonstrate the form of its entries. Example:

Safety device for package reactor in nuclear power stations  
Citation order:

Nuclear power stations: package reactor: safety device  
UDC No. 621.311.2:621.039.577:621.039.587

(The number has been obtained with the help of UDC  
FID 351/1964)

Index entries:

*in* Nuclear power stations: *for* package reactor: safety device.

*for* package reactor: *in* Nuclear power stations: safety device.

safety device: *in* Nuclear power stations: *for* package reactor

In a single-entry system, the number will be 621.311.2:621.039.

The almost mechanical nature of the formation of index entries, based on the helpful alignment of descriptors conforming to the standard citation order 1:2:3, 2:1:3, 3:1:2 is an advantage over rotated A/Z index. Earlier a suggestion had

been made for having a fourth index entry 3:2:1 to make the A/Z index comprehensive.

In all these index entries, the primary and secondary facets are so closely knitted that they cannot be separated by the tertiary facet. The realignment of descriptors in the secondary index entry is based on this principle which can further be used for extension of the cyclic indexing for manipulating four descriptors.

The helpful sequence of descriptors in such index entries will be as follows :

- (i) 1:2:3:4
- (ii) 2:1:3:4
- (iii) 3:1:2:4
- (iv) 4:3:2:1

where 1,2,3,4 represent the order of alignment of descriptors in the standard citation order of facets of a subject at the pre-coordination stage. The pattern of these index entries, being only an extension of the system with three descriptors, is prescribed by the guideline which stipulates that 1 and 2 should not be separated from one another, and that 1,2,3 should remain together as a closely woven concept in all index entries.

Accordingly, those index entries wherein 1,2,3, is separated by 4 are rejected.

The facet 4, being the least concrete among them, is naturally placed at the end of each of the first three index entries while the fourth one represents the primary index at full length chain when the same class number undergoes chain indexing in single-entry system.

The other alternative would have been to permute all these descriptors. This would generate 24 full-length index entries, a majority of which would, however, be redundant. Moreover, such an enormous output of index entries can only be handled conveniently by a machine. As such, only a selection of index entries can be made for a manually operated indexing system taking care that it should not be arbitrary,

and index entries, thus generated, should be logical and conform to the 'standard' citation order.

The useful feature of these index entries lies in the fact that they, being consistent with standard citation order, are helpful and logical. Distributed relatives at the post-coordination stage present no problem because each of them will become an entryword to index entries by turn.

### **Role of classification**

The use of a classification scheme along with indexing systems has a definite advantage. The seepage is minimised due to index entries being delimited by class numbers. When UDC schedule is used, multiple facets of a subject is represented by elements of its UDC number and so the term (descriptors) to denote the subject can be selected from the same schedule. These descriptors, being contained in the enumerated UDC schedule, can be considered as standard or authorised terms, and ambiguities, generally resulting from the use of natural language, can thus be avoided to a considerable extent. Terms can, however, also be selected from the title or text to replace the obsolete ones when the needed terms are not available in the schedule. The reasons are quite obvious. The UDC schedule contains certain undeveloped subjects i.e., plasma physics, solid state physics, guided missiles, astronautics etc. The assignment of co-extensive UDC number to many such subjects is not possible at this stage. In chain indexing, classification numbers play an important role and as such they have to be co-extensive for successful operation of the index. But in cyclic index, the role of classification is limited to delimitation of subject fields, linking index entries with classified elements and selection of suitable terms where an enumerated scheme is used.

### **Extended form**

Marvelled at the astonishing performance of the computer at data processing, its capacity for information processing and retrieval is generally overestimated. The problems confronting these two systems are basically different in nature because the discretion and judgement, which are essential for determination

of the sense and syntactic inter-relationships between terms, can best be exercised by a human mind. Consequently, in mechanised abstracting, this problem of relationships between terms, involving semantic and syntactic factors, is solved by indirect approach of statistical analysis of word frequencies. Besides, auto-indexing is costly because only a very high-speed computer can accelerate the process of manipulating any form of keyword indexing. So, the prohibitive cost of mechanized indexing makes its use still a remote possibility for an average collection. Moreover, entirely mechanised indexing system (i.e. KWIC, KWOC etc.), even after involving human factors, entails a number of disadvantages, i.e, irrelevant terms crop up reducing the chances of recall.

Although cyclic indexing, in its present form, can handle only a limited number of descriptors, this does not stand in the way of its adaptation for an average collection unless subjects, as represented therein, are so highly complex as to require more descriptors than what can be provided under this system at present.

The aforesaid idea of cyclic indexing in a single-entry system involving rotation of 3 components for deriving entries for the construction of alphabetical subject index to a classified file had been developed and put forward by the author as early as 1966 with an ultimate aim of producing mechanised indexes. The system had further been developed by him later in 1968 for incorporating 4 components. The PRECIS, which was developed by Derek Austin in 1971, bears a remarkable similarity to the cyclic indexing so far as the configuration of index entries are concerned. The coincidence is not accidental but is the result of following a logical principle of classificatory ideas which is not necessarily the thought content embodied in a sequence of digits of a class number.

The cyclic indexing system aims at orienting the keywords which are generally derived from titles, and sometimes from the abstracts or texts of documents. The importance of keywords lies in the fact that they constitute an essential instrument of recall. The techniques of recall (or retrieval) based

on the orientation of keywords are indigenous to requirements of individual systems. This implies that the alignment of keywords will not follow the same pattern everywhere. Thus, the cyclic, uniterm or on-line systems have their own problems. Naturally, the cyclic indexing will differ from the usual library cataloguing practices. There is no denying the fact that the conventional methods based on one of several cataloguing codes and rules can be considered as adequate when a library grows up slowly through the years and the gradual accumulation of holdings are conveniently processed. But when the stock is acquired against a crash programme and documents arrive in overwhelming numbers, the need for an alternative method is keenly felt. The printed lists of subject headings are of little use in the face of an ever expanding subject field. New disciplines emerge and subject horizons widen with the synthesis and proliferation of ideas. Obviously the conventional system of subject indexing with the help of printed lists of subject headings cannot hold the overwhelming numbers. What is needed is an indexing system that can be considered as an answer to the problem of information explosion. This implies that new direction has to be scanned while maintaining the basic principles of subject indexing.

Looking back into the past, one can visualise the viability of the traditional library methods to cope with such new situations and the rise it has given to a new class of information managers and also high speed mechanical manipulation of terms to create dissemination indexes like KWIC, KWOC and their variations. The basic principles of subject indexing as enunciated by Cutler, Kaiser and others have been side-tracked for achieving speed, and nothing has gone worse for it. The time has come to understand that too much reliance on the conventional methods has stultified the techniques originally connected with library science to the point of immobility. Ways and means to solve the impasse can be found through innovations.

The chain indexing was a novel concept and had dominated the scene for a long time. But as people tried to adopt

it, difficulties were felt and limitations were exposed. Then new ideas were sought. The implications of this system have been discussed in detail. Even then, the exposition will not be complete unless mentioned again in the perspectives of the proposed cyclic indexing system.

In the absence of an adequate technical staff to handle the rush of incoming documents, the conventional cataloguing practices, being a slow process, cannot keep pace with a fast-growing collection. The possibility of employing chain indexing had been examined when the need arose for the compilation of an A/Z index to the classified file in a large library complex where the author had been working. The problem was similar to one that an indexer faces when preparing subject entries for a classified catalogue. Confronted with the problem of speed, one had to take a close look at the chain indexing system to consider the feasibility of its application for solving the problem. The difficulties which would crop up with the application of chain indexing appeared to be unsurmountable. Chain indexing is totally dependent on traditional library classification schemes which are inadequate as an information retrieval tool in a mechanised environment. These traditional schemes suffer from the disadvantage of their being tied up with the concept of main classes. The problems created by chain indexing are too well known to be recounted. It has many disadvantages. The disappearing chain reduces the utility of subject headings. After the chain procedure has been used to generate subject headings, only one entry is found to be specific while others stand for broader classes. Further, as the specific subject of document is a specialised one, it generates a number of entries for empty links in the chain. Chain indexing is considered to be economical and this is achieved by not taking qualifiers of an entry word below that order in the chain. Chain indexing follows the classified order. While a class number is based on the "concrete to abstract" order, the index entries follow a reverse sequence. In a primary chain, when an abstract term becomes an entry word, the less abstract term becomes the qualifier. The use of abstract terms for information retrieval creates an unhappy situation



which can be remedied through an exceptional transposition of unsought terms. But this proposition is not acceptable due to reasons already discussed. These will, however, come up again as the discussion proceeds.

The other drawbacks of the chain indexing need not be elaborated at this stage. It will be sufficient to say that information retrieval needs some other techniques where transposition of terms is not bound down by a rigid classificatory base.

As the systems existing then were not fast enough, some other methods were sought which could be amenable to mechanisation with the gadgets that were available. At that time, this particular library system had acquired a flexowriter which was being used for the duplication of main entries for preparing unit cards. Those who are familiar with this machine know that it repeats the same entries in a pre-fixed pattern so that each of them is printed in original. A punched paper tape took care of the operation. Then, the problem was to devise an indexing system which could be manipulated by the flexowriter in preparing the desired number of index entries. The successful application of the flexowriter for rapid generation of large number of index entries was a criterion which had to be kept in mind. This meant that the descriptors or index entries had to be manipulated mechanically and yet meaningfully. Besides the transformation of index entries into different patterns should conform to certain logical principles. This will not only avoid the inconsistencies, but establish the system on firm ground consistent with the principles of library science. At this point, it may be noted that computers, which could manipulate those entries, had not arrived on the scene.

Keeping these factors in view, experiments were conducted with cyclic indexing for the construction of an A-Z subject index to a classified file. The cyclic indexing was based on single-entry system instead of multiple-entry system because the former is more economical than the latter. An order involving clockwise and anti-clockwise rotation of the same components constituting the concept of a subject had been adopted to produce the most effective array of index entries for

information retrieval. The single-entry system prevented the classified file from being needlessly proliferated. At the end of experimentation, it was found that this method worked on cyclic rotation of components and elimination of certain less effective index entries according to a logical principle. This has the advantage of cyclic indexing in a multiple-entry system and chain indexing in a single entry system.

The system, thus formulated, is dependent on the transposition of three components or keywords. It was further extended to include four components which were considered adequate to describe a subject and subsequently be applicable for information retrieval provided the descriptors are carefully selected.

The cyclic and PRECIS are pre-coordinate indexing systems. In that respect, they differ from post-coordinate systems like uniterm indexing which is, no doubt, ideal for information storage and retrieval purposes. But, its operation is based on serial numbers of documents and has no classificatory base. Pre-coordinate indexing systems are useful in ordering bibliographies, citations etc. Further, the fact that it can be operated with a classifier as the base for producing A/Z index entries enhances its utility. Considering that an ideal indexing system would be the one that combines the functions of an information retrieval tool with the aforesaid requirements, the quest will be to find out how much more useful is the cyclic indexing. If it can fulfil the necessities of an all-purpose indexing system, then, when fully developed, it would fulfil the needs of all. The cyclic indexing in a single entry system meets the criteria of an all-purpose indexing system to a considerable extent. The cycling of a string of terms to bring each one to the front in turn is not a new idea. But the simple mechanical rotation creates more problems than it can solve. Each term, no doubt, forms an access point but the location of the desired topic through keywords is not all that easy because the alphabetical arrangement of the distributed relatives scatters the otherwise related entries. Thus the major advantage of the pre-coordination would have been lost had not the classified file taken care of it by effecting cohesion of ideas underlying the subjects.

The cyclic indexing can be used for generating subject entries for their being utilized as an alphabetical index to a classified file while preparing a conventional library catalogue. The index entries structured with the help of cyclic indexing may be used for ordering the citations in bibliographies. They are also equally suitable for information retrieval purposes because the descriptors are continually shifted in index entries in such a manner that each of them becomes an entry word by rotation. The pattern of rotation is fixed according to the cited formula. All are familiar with the coordinate indexing system. In this pre-coordinate indexing system, keywords are selectively combined to denote certain ideas which, when in conformity with the user profile, are helpful in retrieving the desired subject or concerned documents. At this point, one has to remember that the 'permutation' of terms leads to chaos while the case with the 'combination' is different. The combination of terms gives rise to a limited number of entries which is essentially related to the cyclic indexing. The index entries, derived through cyclic indexing, are quite effective in information retrieval provided the terms are carefully selected, the totality of which should be able to denote a subject of any depth.

The problem that one has to encounter in indexing is semantical because the relationship between words is not yet properly understood. The difficulties become acute in the case of non-inflected languages like English. The heavily inflected Russian language presents lesser problems. The relationships between words in case of a non-inflected language are established with the help of prepositions. The modern indexing systems like PRECIS, Coordinate indexing, KWIC etc., attempt at not using the prepositions. Instead, they have introduced an elaborate system of operators for establishing the relationship between words. For example, PRECIS uses Role operators. These are of 3 types i.e. Main line operators, Interposed operators and Differentiating operators depending upon the functions they are supposed to perform. These are meant to denote various types of relationships and are quite complex in character. The coordinate index on the other hand

uses roles, links and weights for an identical purpose. The functions and meaning of "weights" are yet imperfectly understood. In KWIC (Keyword-in-context) indexes, all supposedly irrelevant words (including prepositions and conjunctions) are omitted from the index entries with the help of a programmed computerised stop list. The absence of relational terms reduces the effectiveness of these indexes. This sacrifice has to be made for achieving the speed in fast dissemination of information. But the question can be posed whether it is at all necessary to discard the meaningfulness of index entries for the sake of mechanisation. The speed is an essential factor of modern life and mechanisation is one of the means to it. But the adoption of role operators in the PRECIS is a delaying factor because the choice of appropriate type of operators and distinctive symbols had to be manually performed.

The subsequent process of structuring index entries through computer may be a fast one, but the overall economy achieved in terms of time and manpower has yet to be studied to establish the effectiveness of the system.

The cyclic indexing makes use of simple prepositions to establish the needed relationship between words and phrases. The problem of semantics is thus solved without resorting to a complex array of relational operators.

When A, B and C represent 3 individual but interrelated elements (or descriptors), the index formula is obtained by rotation of these terms according to a predetermined logical principle. The index entries, thus derived, will assume the following form:

A : B : C

C : A : B

C : B : A

B : A : C

The third index entry occurring in the above sequence starting with the same descriptor as the one immediately preceding it may be considered as superfluous at a casual glance. But the position is far from it. It represents the primary index

entry with full-length chain containing all the elements as is derived through chain indexing in a single-entry system.

When the number of descriptors is extended to 4, there is no increase in the quantum of index entries. For example, let the 4 descriptors be represented by the letters A, B, C and D. Then the formula for the index entries will be as follows:

A : B : C : D  
 B : A : C : D  
 C : A : B : D  
 D : C : B : A

The basic idea behind the index formula for 3 descriptors is that A and B, being closely interrelated "concrete to abstract" keywords, should not be separated from one another. The idea is further extended in case of index entries dealing with 4 descriptors where the stipulation is that A, B and C should remain adjacent to one another in all the index entries.

It has been noted earlier that the cyclic index, in its fully extended form, is based on four keywords which if chosen with care can denote the idea behind any specific subject. In the case of PRECIS, things are no different. A comparison will be made of the indexing pattern of both these systems. For this purpose, the number of keywords has to be same. Let the four keywords of the cyclic index be represented by the alphabets A, B, C and D. In the case of PRECIS, let there be four keywords which will be denoted by the same alphabets. Now, a comparison between the configuration of index entries represented by alphabets is shown through a diagram below:

Cyclic indexing	PRECIS
A B C D	A
B A C D	B C D
C B A D	B A
D C B A	C D
	C B A
	D
	D C B A

From the representation of these indexing profiles, it will be evident that the pattern of index entries of the cyclic system and PRECIS is identical. The next step is easy. In the

cyclic system, after the keywords have been selected and the computer suitably programmed to manipulate them in a prefixed sequence, the index entries generated will conform to the standard citation order. Some examples are being given to show the deployment of keywords through the cyclic order of indexing.

The formulation of index entries with the help of descriptors loaded with prepositions can best be demonstrated by examples. Therefore, index entries comprising 3 and then 4 descriptors are also being shown here.

Consider the following subject and the corresponding UDC number:

Remote control of guided missiles by pulse-modulated radar systems.

623.451—519 : 621.396.962

The citation formula of the facets of this subject will be as follows:

Whole thing : process : agent.

The citation order of descriptors constituting the subject or the respective index entries will be as under:

- (i) *of* guided missile : *by* radar system, pulse modulated : remote control.
- (ii) remote control : *of* guided missile : *by* radar system : pulse modulated.
- (iii) remote control : *by* radar system, pulse modulated : *of* guided missiles.
- (iv) *by* radar system, pulse modulated : *of* guided missile : remote control.

In these index entries, the relational operators, i.e. 'of' and 'by' are ignored in alphabetical filing. These relational operators (i.e. prepositions etc.) can either be underlined or put inside brackets to distinguish them from the actual descriptors. The entire system is mostly mechanical. Once the indexer finalises the keywords and their citation order, the machine can take over and print the desired number of entries according to the index formula.

An example showing a subject which is denoted by a conjunction of 4 descriptors can be cited. Consider the following

subject and the corresponding UDC number:

Assembly of transmission system of direct petrol injection type engines. 621.434.4—231—77.

The citation order of the facets (or facet formula) of the subject will be as follows:

Whole thing : Kinds : part : operation.

These facets are then substituted by respective index entries as under:

Petrol engine : direct injection type : *of* transmission system : assembly.

The index entries will be as follows :

- (i) Petrol engine : direct injection type : *of* transmission system : assembly.
- (ii) Direct injection type : petrol engine : *of* transmission system : assembly.
- (iii) *of* Transmission system : petrol engine : direct injection type : assembly.
- (iv) assembly : *of* transmission system : direct injection type : petrol engine.

The predominance of special auxiliaries in the UDC number creates the necessary set up for single-entry system.

Experiments had been made with cycling upto 5 keywords and not beyond that. The implication is that a specific subject can be denoted by four keywords provided care is taken to make them meaningful by skilful combination of words. In such eventualities, the keywords may look like phrases which need not be considered as a drawback. Rather, it makes it easier for the indexer to formulate a limited number of descriptors which can be conveniently manipulated to create index entries. Perhaps this statement can be clarified through an example.

Consider the following subject:

Researches on the application of supersonic vibrations to submarine detectors.

623.983 : 534—8.001.5

The subject can be denoted by a combination of a number of keywords which can be shown in "concrete to abstract" order as under:

Submarines : detector : supersonics : vibrations : research on.

The idea can be expressed by only 4 descriptors as follows :  
Submarine: supersonic detectors: vibrations: research on.

Even 3 descriptors can be transformed into phrases which would be adequate to express the same idea:

Submarine detectors: supersonics vibrations: research on.

The indexing system, described so far, can be further developed and refined especially as mechanical gadgets like computers have now been developed for fast manipulation of keywords for the generation of index entries. The present system has its own advantages for being simple and easy to operate. The keywords or phrases serving as keywords can also be used as uniterms in coordinate indexing. Finally, it may be assured that it will work.

### Postscript

The BS 1000 M, produced after an interval of 25 years since the earlier edition (1961) had been published, is the latest schedule now in existence. Its utility is unquestionable in operations involving classification of subjects and their alignment in desired sequence to serve a variety of purposes that have been discussed earlier. This schedule is much more extensive with vastly increased coverage spanning a spectra of more subject fields than ever before. The enumerative tables are so detailed, and the range so wide that the users may be awed by it, so, the problems that an user is likely to face while engaged in classification have been studied from all possible angles and solutions provided where needed mostly in chapters 4 and 5.

The BSI (British Standards Institution) has also produced machine-readable versions of the UDC (1985) schedule and tape and disc which makes it amenable to computerised manipulation. The machine-readable UDC classified file can serve as the store. This, coupled with the computer-based cyclic



indexing, will provide an ideal mechanism for an ISR (information storage and retrieval) system. Such a combination, operating at high-speed, will usher a landmark in the realm of information management and go a long way in containing the overwhelming numbers.

Between the period spanned by the publication of the abridged BS 1000A (1961) schedule and BS 1000M (1985), a number of fascicules of the UDC covering a wide range of subjects had been published. The tables therein are enumerated to the minutest detail, and the presentation follows the pattern as laid out in the BS 1000A (1961), which has been in existence for the past 25 years. Those who are familiar with the abridged schedule will have little or no problem in the use of these fascicules. So, it will be superfluous to provide any guidance for their application. Moreover, technology has moved fast enough during the past decades to render these fascicules somewhat out of date. Still, these are useful for constructing co-extensive class numbers for some specific subjects which have not been enumerated in detail in the UDC (1985) schedule. An example is given below:

669.15—196.591:620.175	Torsion tests on acicular high-carbon ferrous alloy
from 669.15—196.591	Acicular high-carbon ferrous alloy
and 620.175	Torsion tests

This number has been formulated with the help of UDC BS1000 (669): 1949 and UDC(1985) schedule.

Considering that it may be useful for the users to have an idea about the fascicules and subjects covered by them, a list of these publications has been appended at the end of this chapter.

In conclusion, it can be stated that the system of classification as is practised today will live through the ages undergoing refinement at successive stages to meet the exigencies of advancing frontiers of arts, science and technology. Those who will master the skill will find themselves at an advantage with capacity to classify the recorded thoughts that constitute the universe of knowledge.

**UNIVERSAL DECIMAL CLASSIFICATION (UDC)  
FASCICULES**

1. 1000A: 1961 Universal Decimal classification, Abridged Edition
2. 1000C: 1963 Guide to UDC, AMD 3178
3. 1000: AUXILIARIES: 1974, Auxiliary Signs and Sub-Divisions (except those of place)
4. 1000 :AUXILIARIES I (e): Part 1: 1980 Common Auxiliaries of Place (1/2)
- \*5. 1000: AUXILIARIES I (e): Part 2: 1983 Auxiliaries Table I (e)
6. 1000(0): 1972 Generalities, AMD 1296, AMD 1436
7. 1000(1): 1969 Philosophy, AMD 2823
8. 1000(159.9): 1969 Psychology, AMD 2952
9. 1000(2): 1973 Religion
10. 1000(3/30): 1980 Social Sciences in General. Sociology, Sociology
- \*11. 1000(31) : 1982 Statistics, Demography, Population Studies
12. 1000(32): 1971 Politics
13. 1000(330): 1969 Economics
14. 1000(331): 1971 Labour
15. 1000(333): 1969 Land and Landed Property
16. 1000(334): 1969 Cooperation
17. 1000(335): 1969 Socialism
18. 1000(336): 1971 Finance, Public Finance, Customs, Banking and Monetary System
19. 1000(337): 1969 Customs Policy
20. 1000(338): 1970 Production of Wealth, Production, Trend of the Economy, Economic Situation
21. 1000(339): 1970 Distribution, Conservation and Consumption of Wealth
22. 1000(35/354): 1972 Public Administration
23. 1000(355/359) 1971: Military Arts and Science. National Defence, Armed Forces

24. 1000(36): 1970 Social Welfare and Relief
25. 1000(368): 1971 Insurance
26. 1000(37): 1975 Education, Teaching, Training, Leisure
27. 1000(38/382): 1969: Trade, Commerce
28. 1000(383/389): 1971 Communications, Transport, Metrology, Weights & Measures, AMD 1343
29. 1000(39): 1970 Ethnology, Ethnography
- \*30. 1000(5/50): 1983 Exact Sciences in General. Nature Study  
Conservation Environmental Sciences
31. 1000(51): 1976 Mathematics, AMD 3697
32. 1000(52): 1977 Astronomy, Astrophysics, Space Research  
Geodesy
33. 1000(53): 1974 Physics, AMD 2765
34. 1000(54): 1972 Chemistry, Crystallography, Mineralogy  
AMD 2742, 1367
- \*35. 1000(55): 1982 Earth Sciences. Geology. Geophysics
36. 1000(56): 1981 Palaeontology
37. 1000(57): Biological Sciences in General, Virology, Microbiology
38. 1000(58): 1979 Botany
39. 1000(59): 1980 Zoology
40. 1000(6/60): 1979 Applied Science in General, Inventions  
and Discoveries
41. 1000(61/611): 1968 Medical Science in General, Anatomy,  
AMD 3037
42. 1000(612): 1968 Physiology
43. 1000(613): 1980 Hygiene Generally, Personal Health, and  
Hygiene
44. 1000(614): 1969 Public Health, Accident Prevention
45. 1000(615): 1979 Pharmaceuticals, Therapeutics, Toxicology
46. 1000(616): 1970 Pathology, AMD 2953
47. 1000(617): 1958 Orthopaedics, Surgery, Ophthalmology
48. 1000(618): 1968 Gynaecology, Obstetrics
49. 1000(619): 1978 Veterinary Science

50. 1000(62/62.9) 1980 Engineering, Technology in General Characteristics and Details of Machines Equipment Plant, Processes and Products
51. 1000(620): 1973 Materials Testing, Commercial Materials, Power Stations, Economics of Energy
52. 1000(621/621.0): 1973 Mechanical Engineering in General Nuclear Technology
53. 1000(621.1/.22): 1979 Heat Engines in General, Steam Power, Steam Engines, Boilers, Water power, Hydraulic Energy
54. 1000(621.3): 1975 Electrical Engineering
55. 1000(621.4): 1976 Heat Engines (Other than Steam Engines)
56. 1300(621.5): 1971 Pneumatic Energy, Machinery and Tools Refrigeration and Liquefaction Techniques and Plants AMD 3035
57. 1000(621.6): 1973 Fluids Handling Storage and Distribution Plant and Equipment AMD 2763
58. 1000(621.7): 1977 Plastics of Chipless Working Forming and Treatment of Materials AMD 3003
59. 1000(621.8): 1976 Mechanical Power Transmission, Machine Elements, Gearing, Materials Handling Mechanical Attachments, Fixing, Fastners, Lubrication AMD 3036
60. 1000(621.9): 1976 Working, Machining with Chip Formation, Cutting, Grinding Sheet Working Etc. 14.00.
61. 1000(622): 1979 Mining
62. 1000(623): 1974 Military Engineering AMD 2764
63. 1000(624): 1981: Civil and Structural Engineering in General
64. 1000(625): 1976 Civil Engineering of Land Transport Rly. Engineering, Highway Engineering
65. 1000(626): 1977 Hydraulic (Water) Construction Works
- \*66. 1000(628) Public Health Engineering, Water, Illuminating Engineering

67. 1000(629): 1977 Transport Vehicle Engineering
68. 1000(63/632): 1981 Agriculture in General, Forestry Plant Injuries, Diseases and Pest, Plant Protection
69. 1000(633/635): 1981 Specific Crops Horticulture AMD 3911
70. 1000(636/639): 1981 Animal Breeding, Animal Produce, Hunting, Fishing
71. 1000(64): 1971 Home Economics
72. 1000(55/651+659): 1968 Industrial and Business Management and Organisation, Communication
- \*73. 1000(654): 1983 Telecommunication and Telecontrol (Organisation, Services)
74. 1000(655): 1970 Graphic Industries, Printing, Publishing Book Trade
- \*75. 1000(656): 1982 Transport and Postal Services, Traffic Organisation and Control
- \*76. 1000(66/66.0): 1983 Chemical Technology, Chemical Engineering, Production and Processing Operations and Plant
- \*77. 1000(661): 1983 Chemical Products
- \*78. 1000(662): 1983 Explosives, Fuels
79. 1000(663/664): 1971 Beverages, Stimulants, Narcotics, Manufacture and Preservation of Solid Foods AMD 1368
80. 1000(665): 1979 Oils, Fats, Waxes, Adhesives, Gums, Resins
81. 1000(666): 1971 Glass and Allied Industries, Ceramics Clay and Allied Industries, Gypsum Lime Cement and Allied Industries
82. 1000(667): 1979 Colour Industries (Dyes, Inks Paints etc.)
83. 1000(669): 1979 Metallurgy
84. 1000(67/673): 1971 Various Industries, Trades and Crafts Precious Metal and Precious Stone Industries, Metal Goods AMD 2741

85. 1000(674): 1970 Timber and Wood Working Industry,
- \*86. 1000(675): 1983 Leather Industry, 14.00.
87. 1000(676): 1971 Pulp and Paper Industry, Production of Pulp, Paper and Board
88. 1000(677): 1981 Textile Industry, AMD 4320
89. 1000(678): 1981 Industries Based on Macromolecular Materials, Rubber, Plastics
- \*90. 1000(679): 1983 Industries Based on Various Processable Materials, Stone Industry, Cable and Cordage Industries
- \*91. 1000(68/681.3): 1982 Finished Articles in General, Precision Mechanism, Horology, Instrumentation Data Processing Equipment
92. 1000(681.5): 1976 Automatic Control Engineering AMD 3002 & AMD 4115
93. 1000(681.6): 1971 Graphic Reproduction, Machines and Equipment
94. 1000(681.7): 1975 Optical Apparatus and Instruments AMD 2710 & AMD 4116
95. 1000(681.8/.9): 1972 Technical Acoustics, Musical Instruments Engraving and Sculpting Machine AMD 1170
96. 1000(682/683): 1973 Smithery, Farriery, Hand Forged Iron work, Ironmongery, Hardware, Locksmithing, Gun Smithing, Bottling, Lamps, Stoves
97. 1000(684): 1979 Furniture and Allied Industries
98. 1000(685): 1972 Travel, Sports, Games and Other Equipments
99. 1000(686): 1971 Bookbinding, Metalizing, Mirror Making, Stationery
100. 1000(687): 1970 Clothing Industry, Articles of Toilet
101. 1000(688/689): 1980 Fancy Goods, Toys Hobbies,
102. 1000(69): 1981 Building
103. 1000(7/7.0): 1976 The Arts in General, Theory, History, Techniques
104. 1000(71): 1976 Physical Planning

- 105. 1000(72): 1975 Architecture
  - 106. 1000(73/76): 1977 Various Arts and Crafts
  - 107. 1000(77): 1968 Photography
  - 108. 1000(78): 1971 Music
  - 109. 1000(79): 1971 Recreation, Entertainments, Amusements,  
Pastimes
  - 110. 1000(8): 1971 Language, Linguistics, Literature
  - 111. 1000(9): 1972 Geography, Biography, History AMD 1150
  - 112. 1000(9): 1972—Supplement No. 1 Index to the Selection  
of Common auxiliaries of Place for use with UDC 9
- \*Issued during 1982 and 1983

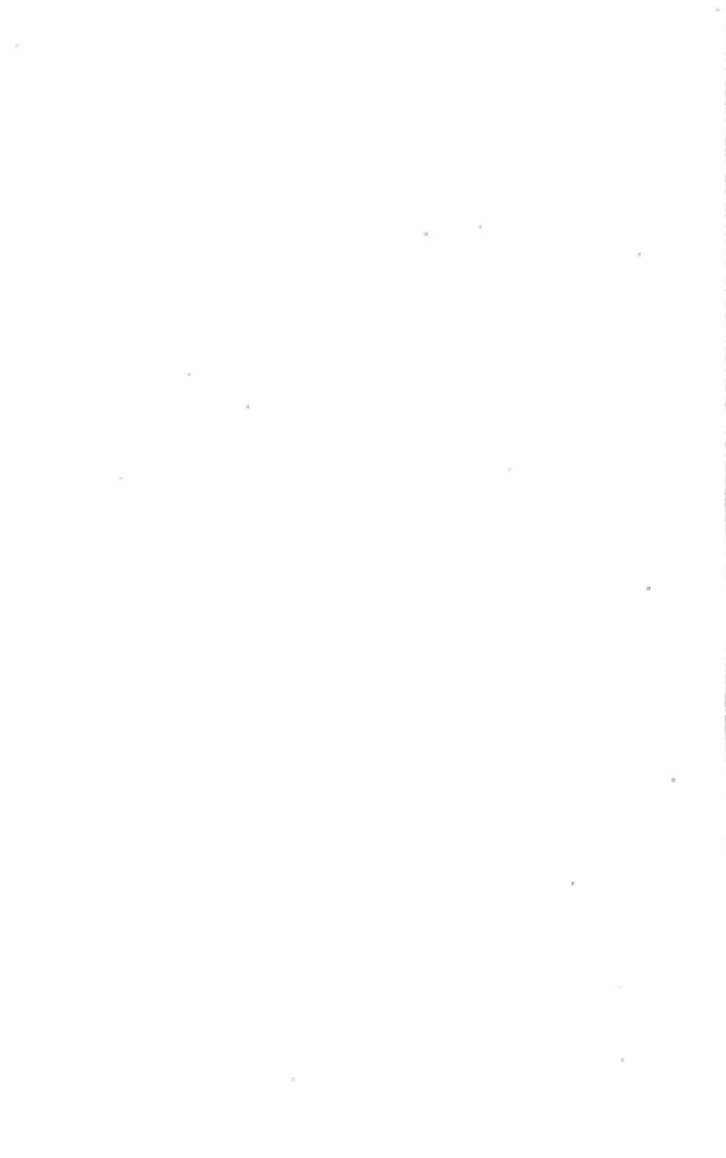
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